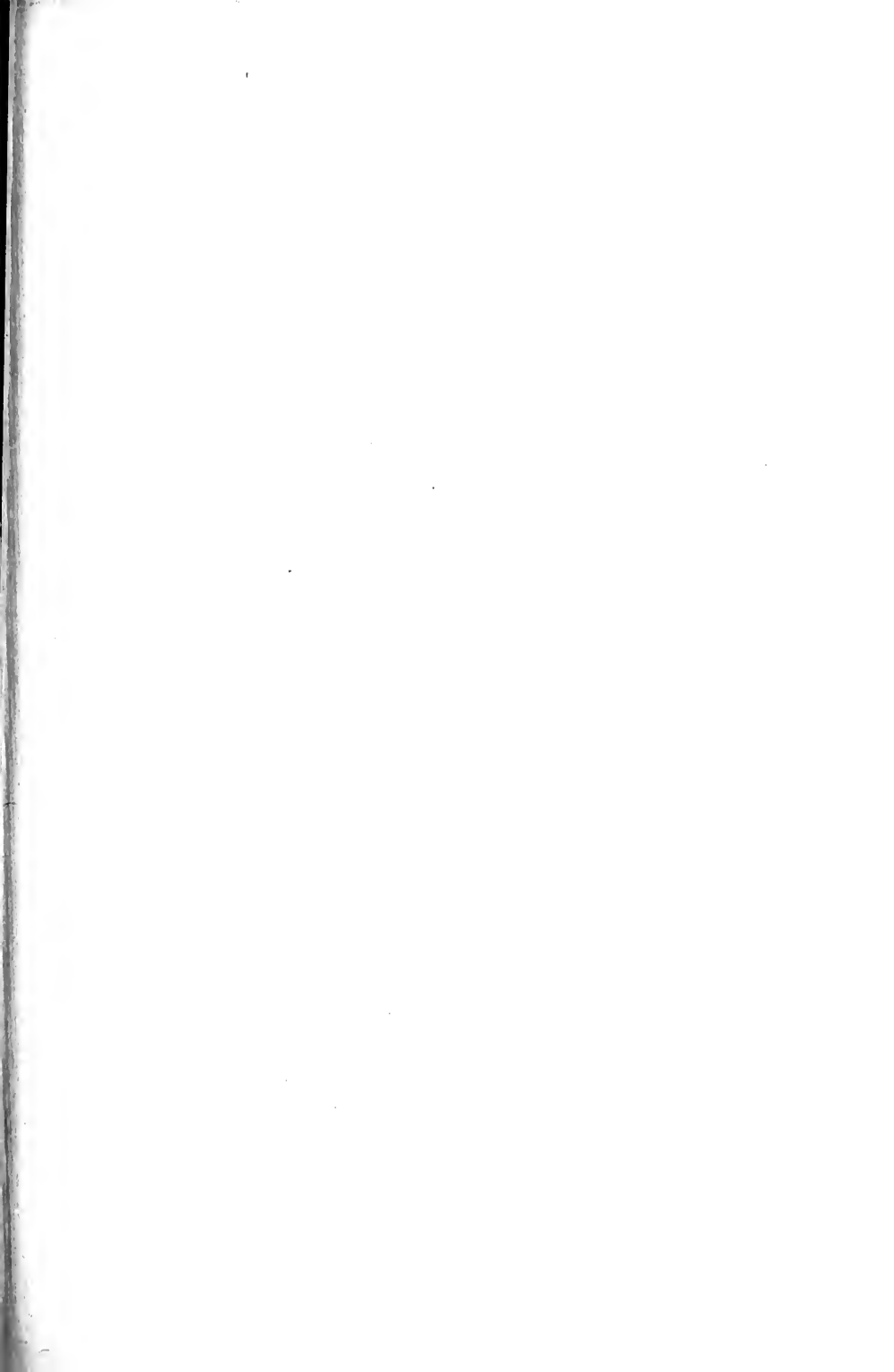




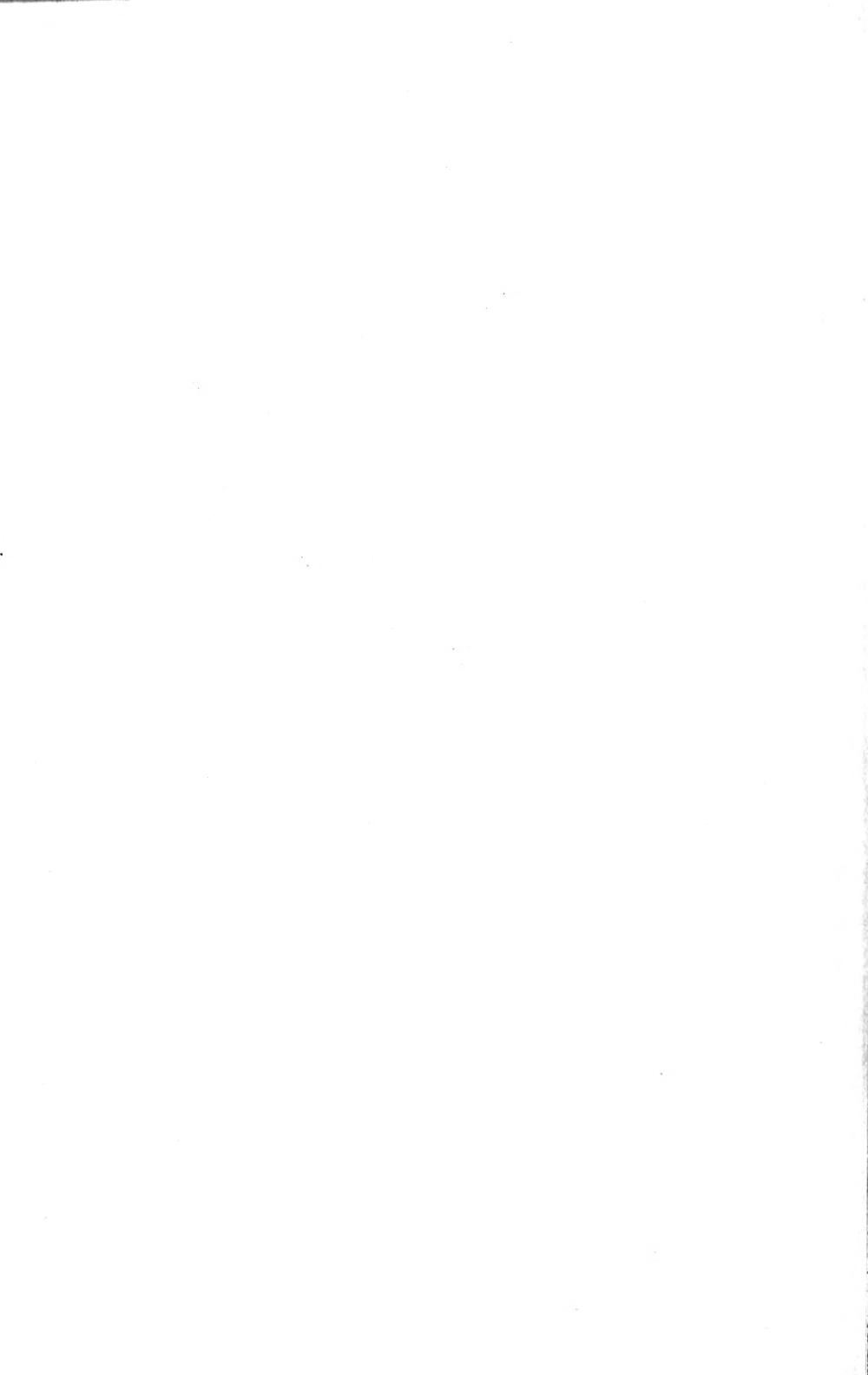
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Edinburgh Medical Journal



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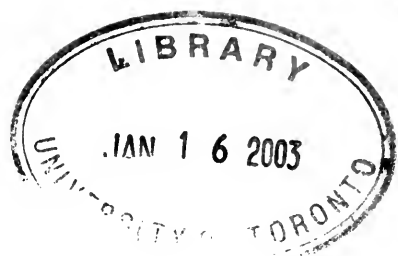
With which is Incorporated the
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EDITED BY
ALEXANDER MILES AND J. S. FOWLER

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MEDICAL EDUCATION IN SCOTLAND

ACCORDING to the Regulations of the General Medical Council, a candidate for a medical qualification must (1) pass a preliminary examination; (2) register as a medical student; (3) study for five years at a recognised school; (4) obtain a degree or diploma; and (5) place his name on the *Medical Register*. No person whose name is not on the *Register* may legally sign certificates, give medical evidence in Courts, or sue for fees.

The following degrees and diplomas are available in Scotland:—Bachelor of Medicine and Bachelor of Surgery (M.B., Ch.B.), conferred by the Universities. Doctor of Medicine (M.D.) and Master of Surgery (Ch.M.) are higher qualifications conferred only on those who already hold the M.B., Ch.B.

The *Triple Qualification* (L.R.C.P.E., L.R.C.S.E., L.R.F.P.S.G.) is conferred by the two Royal Colleges and the Royal Faculty jointly. The Fellowships, Memberships, and Licences of these Corporations may also be registered as higher or additional qualifications.

Special degrees and diplomas in public health are also granted by the Universities and Corporations.

THE UNIVERSITIES.

PRELIMINARY EXAMINATION.—Before commencing his course of medical study each student shall pass a preliminary examination in (1) English, (2) Latin, (3) Mathematics, and (4) an additional language—Greek, French, German, Italian, or such other as the Senatus shall approve. In the case of a candidate whose native language is other than English, an examination in another classical language—*e.g.* Sanskrit or Arabic—may be substituted for Latin, and an examination in the candidate's native language may be substituted for the additional language. A student must pass all the subjects at not more than two examinations. A degree in Arts or Science of any recognised University exempts from the preliminary, and certain other examinations may be accepted as substitutes.

MATRICULATION.—Having passed the preliminary examination, the student must, within fifteen days after the commencement of the session, matriculate at the University and pay the fee, which is £1, 1s. for the whole year, 10s. 6d. for the summer session alone.

REGISTRATION.—Within fifteen days of commencing his studies he must register as a medical student. He must be not less than sixteen years of age, must have passed the preliminary examination, and must show that he has begun his medical studies.

THE CARNEGIE TRUST.—This Trust is prepared to pay a portion of the class fees of students (who have passed the specified preliminary examination) for all classes, whether attended within the Universities or in any of the Extramural Schools. It is also prepared to pay the fees for the various special classes given by many of the Lecturers upon advanced and non-compulsory subjects. Applicants (1) must be over sixteen years of age; (2) must be of Scottish birth or extraction, or must have given two years' attendance after the age of fourteen at a school or institution under inspection of the Scottish Education Department; and (3) must be qualified by preliminary examination under the ordinances of the Scottish Universities Commission and the regulations of the Scottish Universities Entrance Board, to attend the classes for which payment of fees has been claimed.

Medical Education in Scotland

Schedules of application for admission to the benefit of the Trust are obtainable by written application to the Secretary of the Trust, 22 Hanover Street, Edinburgh.

UNIVERSITY OF EDINBURGH.

The University of Edinburgh offers many attractions to the student of medicine. The various departments are well equipped for purposes of teaching and research, and there are ample facilities for clinical instruction. The Royal Infirmary, the Royal Hospital for Sick Children, and the Royal Maternity Hospital are in the immediate vicinity of the University, while the Royal Asylum for the Insane, the Fever Hospital, and the various dispensaries can be reached within half an hour.

Students may attend one half of their classes in the Extramural School, and are thus offered a choice of teachers on the different subjects of the curriculum.

An important agreement between the University and the Royal Infirmary has been reached by which the teaching resources of the latter are more fully available for University students than formerly. The agreement provides that all the senior members of the Infirmary staff (those in charge of wards) become senior University lecturers and examiners, while the assistant physicians and surgeons become University lecturers, and take a share in the clinical teaching. The clinical tutors also take a recognised place in University teaching, and the medical demonstrations are held at a morning hour instead of in the evening.

The social side of student life is provided for in many ways. The University Union, with a membership of 1500, has a debating-hall, a library, reading rooms, billiard rooms, and a catering department.

The Royal Medical Society, founded in 1737, offers the student the advantages of an extensive medical library and reading rooms, while in its spacious hall many whose names have since become famous have made their first essay in medical debate. The Australasian Club and the South African Union are the headquarters of students from these parts of the Empire.

The Town and Gown Association provides a number of student residences, which are managed by a committee of the residents.

Women students are now admitted to the systematic lectures and practical classes within the University and to the clinical classes in the Royal Infirmary.

Under a recent regulation attendance on classes of instruction in the various special departments is compulsory. This change has necessitated a rearrangement of the curriculum, and an important regulation was introduced which has the effect of limiting a student's attendance on later subjects of the curriculum until he has passed the professional examinations on the earlier subjects.

Particulars regarding the curriculum will be found in the University calendar or "medical syllabus," published by James Thin, 55 South Bridge.

It is recommended that students begin study in the Summer Session.

The curriculum is as follows :—

FOR STUDENTS BEGINNING IN SUMMER.

First Summer Term—

	Hour of Meeting of Class.
Botany	8-9
Practical Botany (on days to be arranged)	9-11
Physics	12-1
Practical Anatomy (thrice weekly)	Afternoon

(Examination in Botany and Physics.)

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First Year.

Winter (1st Term)—

	Hour of Meeting of Class.
Practical Chemistry (twice weekly) (in sections).	
Anatomy	11-12
Chemistry	12-1
Zoology (Mondays and Fridays)	2-3
Practical Zoology (twice weekly)	
Practical Anatomy	Daily

Winter (2nd Term)—

Practical Chemistry (twice weekly) (in sections).	
Anatomy	11-12
Chemistry	12-1
Zoology (Mondays and Fridays)	2-3
Practical Zoology (once weekly)	
Practical Anatomy	Daily

(*Examination in Chemistry and Zoology.*)

Summer Term—

Histology (in sections).
Practical Anatomy.

Second Year.

Winter (1st Term)—

Physiology	10-11
Practical Physiology (twice weekly)	11-1
Practical Anatomy and Demonstrations.	

Winter (2nd Term)—

Physiology	10-11
Practical Physiology (twice weekly)	11-1
Practical Anatomy and Demonstrations.	

(*Examination in Anatomy and Physiology.*)

Summer Term—

Pathology (Practical) (thrice weekly)	8-10
Pathology (Morbid Anatomy)	10-11
Surgical Out-patients	11-12
Clinical Surgery	12-2

Third Year.

Winter (1st Term)—

Medicine	9-10
Materia Medica	10-11
Clinical Medicine	11-1.30
Pathology (including Elementary Bacteriology)	2-3
Pathology (Morbid Anatomy)	3-4
Practical Materia Medica	3-4.30

Winter (2nd Term)—

Medicine	9-10
Materia Medica	10-11
Clinical Medicine	11-1.30
Pathology (including Elementary Bacteriology)	2-3
Pathology (Morbid Anatomy)	3-4
Practical Materia Medica	3-4.30

(*Examination in Pathology and Materia Medica.*)

Medical Education in Scotland

<i>Summer Term—</i>					Hour of Meeting of Class.
Out-patients (Medical)	.	.	.	.	11-1
Vaccination	.	.	.	.	3-4
Dispensary Practice	.	.	.	.	Afternoon

Fourth Year.

Winter (1st Term)—

Surgery	.	.	.	.	9-10
Midwifery (including Gynecology) (men only)	.	.	.	.	10-11
	(women only)	.	.	.	10-11			
* Sec. A. Diseases of Skin	} 11-12	Clinical Surgery	}	12-2	Afternoon			
* „ B. Diseases of Eye								
* „ C. Diseases of Ear, etc.								
Dispensary Practice								
Infectious Diseases (once weekly)								
Anæsthetics. ¹								
Optional Classes. ²								

Winter (2nd Term)—

Surgery	.	.	.	.	9-10
Midwifery (including Gynecology) (men only)	.	.	.	.	10-11
	(women only)	.	.	.	10-11
Sec. "A. Diseases of Ear, etc."	} 11-12	Clinical Surgery	}	12-2	Afternoon
" B. Diseases of Skin					
" C. Diseases of Eye					
Mental Diseases (twice weekly)	.	.	.	.	3-4
Infectious Diseases (if not previously attended)					Afternoon
Dispensary Practice					
Practical Midwifery					

Summer Term—

Operative Surgery	.	.	.	.	8-9.45
Public Health	.	.	.	.	10-11
Sec. A. Diseases of Children	.	.	.	.	11-1
„ B. Diseases of Ear, etc.	} 11-12	Clinical Medicine	}	12-1.30	Afternoon
„ C. Diseases of Skin					
Forensic Medicine	.	.	.	.	2-3
Infectious Diseases (if not previously attended)	.	.	.	.	Afternoon

(*Examination in Forensic Medicine and Public Health.*)

* These classes are held thrice weekly, and on remaining days students must attend Clinical Surgery at 11 o'clock.

¹ Courses of instruction are given in the Autumn and Summer Terms.

² Optional courses are held in the subjects of *History of Medicine* (during the First Term of the Winter Session, twice weekly, 4 to 5 P.M., and may be attended by students who have passed the 1st Professional Examination); *Physical Methods in the Treatment of Disease* (during the First Term of the Winter Session, 4 to 5 P.M., twice weekly, and open to students who have passed the 3rd Professional Examination); *Neurology* (daily at 4 P.M. during the Second Term of the Winter Session, and open to students who have passed the 3rd Professional Examination); *Applied Anatomy* (thrice weekly, from 5 to 6 P.M. during First Term of Winter Session, and students are recommended to take the class in the Fifth Winter).

Edinburgh

Fifth Year.

Winter (1st Term)—

	Hour of Meeting of Class.
Tuberculosis	9-10
Clinical Gynecology	10-11
Sec. B. Diseases of Children	11-1
„ A. Diseases of Eye, 11-12 Clinical Medicine	12-1.30
„ C. Clinical Medicine or Clinical Surgery.	
Dispensary Practice }	Afternoon
Practical Midwifery }	
Optional Classes.	
Venereal Diseases.	

Winter (2nd Term)—

Clinical Therapeutics	9-10
Clinical Gynecology	10-11
Sec. C. Diseases of Children	11-1
Secs. A. and B. Clinical Medicine or Clinical Surgery	12-1.30
Dispensary Practice } if not previously attended	Afternoon
Practical Midwifery }	
Venereal Diseases.	

Summer Term—

Tuberculosis	9-10
Clinical Work in Hospital.	

(Examination in Midwifery, including Gynecology, Surgery, and Medicine, and corresponding Clinical Examinations.)

FOR STUDENTS BEGINNING IN WINTER.

First Year.

Winter (1st Term)—

Practical Chemistry (twice weekly) (in sections)	
Anatomy	11-12
Chemistry	12-1
Zoology (Mondays and Fridays)	2-3
Practical Zoology (twice weekly)	
Practical Anatomy	Daily

Winter (2nd Term)—

Practical Chemistry (twice weekly) (in sections)	
Anatomy	11-12
Chemistry	12-1
Zoology (Mondays and Fridays)	2-3
Practical Zoology (once weekly)	
Practical Anatomy	Daily

(Examination in Chemistry and Zoology.)

Summer Term—

Botany	8-9
Practical Botany (on days to be arranged)	9-11
Physics	12-1
Practical Anatomy	Afternoon

(Examination in Botany and Physics.)

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Second Year.

<i>Winter (1st Term)</i> —				Hour of Meeting of Class.
Physiology	.	.	.	10-11
Practical Physiology (twice weekly)	.	.	.	11-1
Practical Anatomy.				

Winter (2nd Term)—

Physiology	.	.	.	.	.	10-11
Practical Physiology	.	.	.	.	.	11-1
Practical Anatomy and Demonstrations.						

Summer Term—

Histology (in sections).						
Practical Anatomy and Demonstrations.						
<i>(Examination in Anatomy and Physiology.)</i>						

Third Year.

Winter (1st Term)—

Medicine	.	.	.	.	.	9-10
Materia Medica	.	.	.	.	.	10-11
Clinical Medicine	.	.	.	.	.	11-1.30
Pathology (including Elementary Bacteriology)	.	.	.	.	.	2-3
Pathology (Morbid Anatomy)	.	.	.	.	.	3-4
Practical Materia Medica	.	.	.	.	.	3-4.30

Winter (2nd Term)—

Medicine	.	.	.	.	.	9-10
Materia Medica	.	.	.	.	.	10-11
Clinical Medicine	.	.	.	.	.	11-1.30
Pathology (including Elementary Bacteriology)	.	.	.	.	.	2-3
Pathology (Morbid Anatomy)	.	.	.	.	.	3-4
Practical Materia Medica	.	.	.	.	.	3-4.30

Summer Term—

Pathology (Practical) (thrice weekly)	.	.	.	.	.	8-10
Pathology (Morbid Anatomy)	.	.	.	.	.	10-11
Clinical Surgery	.	.	.	.	.	12-2
Vaccination	.	.	.	.	.	3-4

(Examination in Pathology and Materia Medica.)

Fourth Year.

Winter (1st Term)—

Surgery	.	.	.	.	.	9-10
Midwifery (including Gynecology) (men only)	.	.	.	.	.	10-11
					(women only)	10-11
Sec. A. Diseases of Skin	} 11-12	Clinical Surgery.	}	.	.	12-2
" B. Diseases of Eye						
" C. Diseases of Ear, etc.						
Dispensary Practice	}	.	.	.	.	Afternoon
Infectious Diseases (once weekly)						
Anæsthetics. ¹						
Optional Classes. ²						

¹ See Note on p. iv.

² See Note on p. iv.

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Winter (2nd Term)—

	Hour of Meeting of Class.
Surgery	9-10
Midwifery (including Gynecology) (men only)	10-11
(women only)	10-11
Sec. A. Diseases of Ear, etc. } 11-12 Clinical Surgery	12-2
" B. Diseases of Skin	
" C. Diseases of Eye	
Mental Diseases (twice weekly)	3-4
Infectious Diseases (if not previously attended) } .	Afternoon
Dispensary Practice	
Practical Midwifery	

Summer Term—

Operative Surgery	8-9.45
Public Health	10-11
Sec. A. Diseases of Children	11-1
" B. Diseases of Ear, etc. } 11-12 Clinical Medicine	12-1.30
" C. Diseases of Skin	
Forensic Medicine	2-3
Infectious Diseases (if not previously attended)	Afternoon

(Examination in Forensic Medicine and Public Health.)

Fifth Year.

Winter (1st Term)—

Tuberculosis	9-10
Clinical Gynecology	10-11
Sec. B. Diseases of Children	11-1
" A. Diseases of Eye 11-12. Clinical Medicine	12-1.30
" C. Clinical Medicine or Clinical Surgery.	
Dispensary Practice }	Afternoon
Practical Midwifery }	
Optional Classes.	
Venereal Diseases.	

Winter (2nd Term)—

Clinical Therapeutics	9-10
Clinical Gynecology	10-11
Sec. C. Diseases of Children	11-1
Secs. A. and B. Clinical Medicine or Clinical Surgery	12
Dispensary Practice } if not previously attended	Afternoon
Practical Midwifery }	
Venereal Diseases.	

Summer Term—

Tuberculosis	9-10
Clinical Work in Hospital.	

(Examination in Midwifery, including Gynecology, Surgery, and Medicine, and corresponding Clinical Examinations.)

The candidate must attend Hospital for not less than three years ; must attend both Clinical Medicine and Clinical Surgery for a period of at least nine months ; twenty cases of Midwifery, or twelve cases and three months' attendance at a Maternity Hospital ; and Post-Mortem Examinations for three months.

It is required that, before commencing the study of Practical Midwifery, every student shall have held the offices of Clinical Medical Clerk and

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Surgical Dresser, and have attended a Course of Lectures on Surgery and Midwifery.

Two of the five years of study must be spent at the University, and not less than eight of the compulsory subjects of study must be taken in the University.

The minimum expense of M.B. and Ch.B., including fees for Classes, Hospital, Matriculation and Examination, amounts to about £175.

DEGREE OF M.D.

Each candidate for this degree who began medical study after 1st October 1892 must be of the age of twenty-four years or upwards, and must have obtained the degrees of M.B. and Ch.B. of the University. He must either have been engaged for two years in general practice, *or* for one year in the naval or military medical services, or in the medical wards of a hospital, or in scientific research. He must present a thesis written by himself on a medical subject, and pass an examination in Clinical Medicine. In this examination the candidate has to write a report and commentary on at least three cases, and has to show a practical knowledge in the application of the ophthalmoscope, laryngoscope, electrical apparatus, and sphygmograph, in the examination of the blood, and in the chemical and microscopical examination of the excreta.

The candidate who has graduated M.B. and Ch.B. under the old regulations may either proceed to the degree of M.D. under the old regulations (under which he is not required to pass an examination in Clinical Medicine, but must have passed examinations in Greek and in Logic or Moral Philosophy), or he may proceed to the degree as if he had graduated M.B., Ch.B. under the New Regulations.

DEGREE OF CH.M.

Each candidate must be not less than twenty-four years of age, must possess the degrees of M.B., Ch.B., must have attended the surgical wards of a hospital for one year, or have spent one year in scientific research or in the naval or military medical services, or two years in practice other than that restricted to medicine. He must submit a thesis on a surgical subject, and pass an examination on Clinical Surgery and its branches, Surgical Anatomy, and Operations on the Dead Body.

FEES FOR M.D. AND CH.M.

The fee for the M.D. degree under the old regulations is five guineas; for the M.D. or Ch.M., under the New Regulations, fifteen guineas. The candidate must have paid the matriculation fee for the year in which he presents himself for examination or graduation. At each reappearance for examination, under the New Regulations, the fee is five guineas.

DEGREES IN PUBLIC HEALTH.

Two degrees are granted by the University of Edinburgh in the department of Sanitary Science, viz. B.Sc. and D.Sc.

A Diploma in Public Health (D.P.H. Univ. Edin.) is also granted.

BACHELOR OF SCIENCE.

Candidates must be graduates in Medicine of a University of the United Kingdom or of some other recognised University. In order to obtain the degree two examinations have to be passed.

First Examination.—Before entering for this examination the candidate must, after graduating in Medicine, have worked in a recognised Public

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Health Laboratory for eight months, of which five consecutive months must be passed in the Public Health Laboratory of the University of Edinburgh.

He must also have attended in a Scottish University a course of lectures on Physics and a course of lectures on Geology, extending over three months, and approved of by the University Court.

The subjects of examination are as follows :—

- (1) *Laboratory work*—Practical, written and oral ; examination of water, air, foods, beverages, condiments ; sewage ; soils ; disinfectants ; building materials ; clothing ; bacteriology.
- (2) Physics. (3) Geology.

Second Examination.—This cannot be taken until eighteen months after graduating in medicine ; nor sooner than six months after passing the First B.Sc. Examination. The candidate must have attended two separate courses on Public Health, either in the University of Edinburgh or in some other recognised University or School.

Each course must consist of forty lectures, and include Medicine in its relation to Public Health and Sanitary Engineering.

The candidate must likewise produce evidence (1) that for six months he has studied sanitary work under a Medical Officer of Health for a county or burgh of not less than 25,000 inhabitants ; (2) that he has studied clinically for three months infectious diseases in a recognised institution ; (3) that for three months he has been instructed by a recognised teacher in mensuration and drawing.

The subjects of examination are :—

(1) Sanitation ; (2) Sanitary Law ; (3) Vital Statistics ; (4) Medicine in Relation to Public Health.

The candidate is examined orally, practically, and by a written paper. *Sanitation* includes making reports on dwellings, workshop, hospitals and sanitary schemes.

The University Court may modify the work and instruction prescribed from time to time.

DOCTOR OF SCIENCE.

A graduate after having held the degree of B.Sc. for five years may present himself for the D.Sc. He must present a thesis or a published work or memoirs, the result of his own research, and must pass an examination in Public Health, and in such of its special subjects as the Senatus may determine. The candidate must submit the subject in which he proposes to be examined for approval not less than two months before the examination.

FEES PAYABLE.—First and second examinations, £3, 3s. each ; for D.Sc., £10, 10s.

INSTITUTIONS FOR CLINICAL INSTRUCTION IN EDINBURGH.

Royal Infirmary. 921 beds and 42 cots. Fees—perpetual ticket, £12 ; one year, £6, 6s. ; six months, £4, 4s. ; three months, £2, 2s. Clinical instruction is given daily in Medicine, Surgery, and all their special branches.

Royal Hospital for Sick Children. 120 beds. Hospital ticket, £1, 1s. Fee for Qualifying Course, £2, 2s.

City Hospital for Infectious Diseases. 600 beds. Fee, £1, 1s.

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Royal Maternity and Simpson Memorial Hospitals. 40 beds. The Maternity Residency affords accommodation for twelve students.
Royal Asylum, Morningside. 500 beds.
The fee for a qualifying course at each of these last two institutions is £2, 2s.
Royal Victoria Hospital for Consumption and Diseases of the Chest. 50 beds. Out-patient Department at Spittal Street.
Eye, Ear and Throat Infirmary. 6 beds; 2700 Out-patients yearly. Fee, for three months, £1, 1s.
Royal, New Town, Medical Missionary (Cowgate), Western, Provident (Marshall Street), Eye, and Skin Dispensaries.

PROFESSORS AND LECTURERS IN EDINBURGH.

The Courses given by the Extramural Lecturers are recognised by the University and other examining boards as qualifying for graduation.

Botany—

Professor Sir Isaac Bayley Balfour, M.D., Royal Botanic Garden.

Zoology—

Professor J. Cossar Ewart, M.D., University.

Professor J. H. Ashworth, University.

Hugh Miller, F.Z.S., New School.

Biology—

Hugh Miller, F.Z.S., New School.

Physics—

Professor C. G. Barkla, D.Sc., University.

G. A. Carse, D.Sc., University.

Dawson Turner, M.D., Surgeons' Hall.

Chemistry—

Professor Barger, University.

G. H. Gemmell, F.I.C., 4 Lindsay Place.

T. W. Drinkwater, Ph.D., Surgeons' Hall.

Anatomy—

Professor A. Robinson, M.D., University.

J. Ryland Whitaker, M.B., Surgeons' Hall.

Applied Anatomy—

F. E. Jardine, M.B., University.

J. Ryland Whitaker, M.B., Surgeons' Hall.

Physiology—

Professor Sir E. Sharpey Schafer, LL.D., University.

Alexander Goodall, M.D., Surgeons' Hall.

Materia Medica and Therapeutics—

Professor A. R. Cushny, F.R.S., University.

John Orr, M.D., New School.

Pathology—

Professor Lorrain Smith, M.D., University.

D. Murray Lyon, M.D., Surgeons' Hall.

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Surgery—

Professor Alexis Thomson, University.
A. A. Scot Skirving, F.R.C.S., 27 Nicolson Square.
D. P. D. Wilkie, F.R.C.S., Surgeons' Hall.
John Fraser, F.R.C.S., Surgeons' Hall.
W. J. Stuart, F.R.C.S., New School.

Clinical Surgery—

The Surgeons of the Royal Infirmary.
Professor Sir Harold J. Stiles.
Professor Alexis Thomson.
Sir James Hodsdon.
Sir David Wallace.
Alexander Miles.
John W. Dowden.
A. A. Scot Skirving.
And Assistant Surgeons.

Practice of Medicine—

Professor G. Lovell Gulland, M.D., University.
Harry Rainy, M.D., 27 Nicolson Square.
R. A. Fleming, M.D., Surgeons' Hall.
J. D. Comrie, M.D., Dental Hospital.
W. T. Ritchie, M.D., New School.

Clinical Medicine—

The Physicians of the Royal Infirmary.
Professor G. Lovell Gulland.
Professor F. D. Boyd.
Sir R. W. Philip.
Dr R. A. Fleming.
Dr Harry Rainy.
Dr Chalmers Watson.
Dr Edwin Bramwell.
And Assistant Physicians.

Midwifery and Gynecology—

J. W. Ballantyne, M.D., University.
R. W. Johnstone, F.R.C.S., Surgeons' Hall.
G. F. B. Simpson, M.D., New School.
H. S. Davidson, F.R.C.S., Nicolson Square.

Insanity—

Professor G. M. Robertson, M.D., University and Royal Asylum.
John Keay, M.D., Surgeons' Hall and Bangour Village Asylum.

Diseases of the Eye—

J. V. Paterson, M.B., Royal Infirmary.
A. H. H. Sinclair, M.D., Royal Infirmary.

Vaccination—

W. G. Aitchison Robertson, M.D., D.Sc., Royal Dispensary.
W. D. D. Small, M.B., Provident Dispensary.

Diseases of Children—

J. S. Fowler, M.D.
J. Burnet, M.D.

Diseases of the Skin—

Norman Walker, M.D., Royal Infirmary.
Frederick Gardiner, M.D., Surgeons' Hall.

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Diseases of the Ear, Nose, and Throat—

A. Logan Turner, M.D., F.R.C.S., Royal Infirmary.
J. S. Fraser, F.R.C.S., Royal Infirmary.
Douglas Guthrie, M.D., F.R.C.S., Surgeons' Hall.

Forensic Medicine—

Professor Harvey Littlejohn, F.R.C.S., University.
W. G. Aitchison Robertson, M.D., D.Sc., Surgeons' Hall.

Public Health—

Professor C. Hunter Stewart, M.B., University.
W. G. Aitchison Robertson, M.D., D.Sc., Surgeons' Hall.
Wm. Robertson, M.D., Surgeons' Hall.

Fevers—

Alexander James, M.D., City Hospital.
C. B. Ker, M.D., City Hospital.

Bacteriology—

Professor James Ritchie, M.D., University.
Mabel Purefoy Fitzgerald, New School.

Diseases of Tropical Climates—

Lieut.-Colonel D. G. Marshall, I.M.S., University and Surgeons' Hall.

Neurology—

J. J. Graham Brown, M.D., University.

Physical Methods in the Treatment of Disease—

Harry Rainy, M.D., University.

Tuberculosis—

Professor Sir R. W. Philip, M.D., University.
J. Guy, M.D.

Therapeutics—

Jonathan Meakins, M.D., University.

Medical Electricity and Röntgen Rays—

Dawson Turner, M.D., Surgeons' Hall.

Practical Anæsthetics—

J. Stuart Ross, M.B., University.

History of Medicine—

J. D. Comrie, M.D., University.

Venereal Diseases—

David Lees, F.R.C.S., Royal Infirmary.

EDINBURGH POST-GRADUATE COURSES IN MEDICINE.

IN CONNECTION WITH THE UNIVERSITY AND ROYAL COLLEGES.

In connection with the University and Royal Colleges, Post-Graduate Courses are held during the Summer Vacation. Usually there is a General Medical Course, a General Surgical Course, and a Course on Obstetrics and Gynecology.

The details of the Courses vary somewhat from year to year, but the General Medical Course includes:—Lecture-Demonstrations, and, where possible, practical instruction on Medical Anatomy, Medical Side-Room

Glasgow

Work, Examination of the Blood, X-Ray and Electrical Therapy, Morbid Anatomy, and Post-Mortems ; clinical instruction in Medicine, Diseases of Children, Diseases of the Skin, and Infectious Diseases. This year's course also included special instruction in the Methods of Examination of the Nervous, Circulatory, Respiratory, Alimentary, and Renal Systems.

The General Surgical Course includes :—Lecture-Demonstrations on Surgical Anatomy, Surgical Pathology, and Surgical X-Ray Diagnosis ; clinical instruction in Surgery at the Royal Infirmary and the Royal Hospital for Sick Children ; clinical instruction in Venereal Diseases ; Surgical Out-Patients ; Surgical and Gynecological Operations ; and special instruction in Abdominal and Renal Surgery.

The Obstetrical and Gynecological Course includes :—Clinical instruction in both these departments ; Lecture-Demonstrations on Obstetrical and Gynecological Pathology ; practical study in the Ante-natal department of the Royal Maternity Hospital ; and, if desired, instruction in the management of Child Welfare Centres.

In addition to the above, certain other special Courses on, for example, Clinical Therapeutics, may possibly be held during the Academic Terms. These are limited in number and involve the graduate devoting the greater part of his time each day to the work.

Particulars in regard to Courses, dates of commencement, fees, etc., may be had on application to the Hon. Secretary, Post-Graduate Courses in Medicine, University New Buildings, Edinburgh.

UNIVERSITY OF GLASGOW.

DEGREES OF M.B. AND CH.B.

During the last decade there has been a continual expansion of the facilities provided for both scientific and practical training. In 1919 three new Chairs were provided in Organic Chemistry, in Physiological Chemistry, and in Bacteriology, and eight new University Lectureships have been instituted—two in Tuberculosis, one in the Surgical Diseases of Children, one in the Medical Diseases of Children, one in Electrical Diagnosis and Therapeutics, one in Venereal Diseases, and two in Clinical Obstetrics.

The special feature of the school upon the practical side is the classification of the staff of Professors and Lecturers in the subjects of the two final years of study. Systematic as well as clinical classes are conducted not only at the Western Infirmary and adjoining University Buildings, but also at the Royal and Victoria Infirmaries. Students accordingly have the option of taking these subjects either at the Western or the Royal or the Victoria Infirmaries. In this way the advantage is afforded of a very wide clinical field along with systematic instruction under University Professors, and the great disadvantage of attending classes at Gilmorehill and going to the Royal Infirmary, at a considerable distance, for clinical work is thus done away with. The same arrangement has been made in the case of Pathology. There are large and fully equipped Pathological Institutes, with class-room accommodation, at both Infirmaries, each under a University Professor who is *ex officio* Pathologist to the Infirmary, and has control of all the pathological material for purposes of instruction and investigation.

There is a Laboratory for Clinical Pathology at the Western Infirmary, the Director of which is also a University Professor, and gives instruction to University students in the scientific methods of clinical diagnosis.

Under the New Ordinance of the University Court, which came into operation on 1st October 1911, the regulations for these Degrees have been considerably altered, the chief modifications being as follows :—1. A rearrangement of the subjects of the four Professional Examinations. 2. The

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rendering compulsory of some courses which hitherto have been optional.
3. The imposition of restrictions as to the period at which certain subjects of the curriculum can be taken.

The academical year is now divided into three terms of about ten teaching weeks each, and the following list gives the subjects of the several Professional Examinations, with the period of study required :—

FIRST EXAMINATION.

Chemistry (including Organic Chemistry), 2 terms ; with Practical Chemistry 1 term.

Physics (with practical work), 1 term.

Botany (with practical work), 1 term.

Zoology (with practical work), 1 term.

SECOND EXAMINATION.

Anatomy and Practical Anatomy, 5 terms.

Physiology and Practical Physiology, 3 terms.

THIRD EXAMINATION.

Materia Medica and Therapeutics, 2 terms.

Pathology and Practical Pathology, 3 terms.

FOURTH EXAMINATION.

Medical Jurisprudence and Public Health, 2 terms.

Surgery, 2 terms.

Practice of Medicine, 2 terms.

Midwifery and Diseases Peculiar to Women and Infants, 2 terms.

The candidate must have attended the Medical and Surgical practice of a general hospital for three years, and courses of Clinical Surgery and Clinical Medicine of nine months in each case. He must also have received instruction, under conditions laid down, in the following subjects :—

Mental Diseases.

Practical Pharmacy.

Out-Patient Practice.

Clinical Clerking in Medicine.

Clinical Clerking or Dressing in Surgery.

Post-Mortem Examinations.

Infectious Diseases.

Gynecology.

Diseases of Children.

Ophthalmology.

Diseases of the Ear and Throat.

Dermatology.

Practical Midwifery with the Conduct of Cases of Labour.

Vaccination.

Administration of Anæsthetics.

Operative Surgery.

Venereal Diseases.

The following courses cannot be taken till after the end of the terms of the curriculum indicated in each case :—

Physiology and Practical Physiology—third term, and not till all four of the subjects of the First Examination have been passed.

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Materia Medica and Therapeutics, and Pathology and Practical Pathology—sixth term, and not till one subject at least of the Second Examination has been passed.

Medical Jurisprudence and Public Health—after completion of classes for the Third Professional Examination.

Midwifery, etc., Surgery and Medicine—ninth term, with the exception that Surgery may be attended after the sixth term, provided that the candidate has passed the second Professional Examination.

Hospital Practice, Clinical Medicine, Clinical Surgery—sixth term.

The curriculum extends over five years, two of which must be spent in the University of Glasgow. The remaining three years may be spent elsewhere, as indicated in the Ordinance and under the conditions thereby imposed.

Except in the case of Medicine, Surgery, and Midwifery, the Senate may accept the Professional Examinations of other Scottish Universities.

There are a number of other administrative regulations which need not here be specified in detail.

The examination fees are £23, 2s. in all, with an additional fee of £1, 1s. for every re-entry. The cost of the curriculum amounts roughly to £145, spread over the five years of the course, and at present the class fees are charged at so much a class. There is, however, a movement on foot to introduce a "composition" or "inclusive" fee per session, but the total will work out at practically the above figure.

N.B.—The University Court has given notice that the class and examination fees in all the Faculties will be raised as from 1st October 1921.

CLINICAL FACILITIES.

The following general hospitals, all of which are equipped in a modern fashion, are available for instruction of University students, viz. the Western Infirmary close to the University, the Royal Infirmary, to which the new Medical Chairs are attached, each of these having at present about 600 beds, and the Victoria Infirmary, with 260 beds, on the south side of the city.

The Eye Infirmarys at 174 Berkeley Street and 80 Charlotte Street (between them 100 beds), and the Ophthalmic Institution at 126 West Regent Street (35 beds), furnish ample opportunities for instruction in the important branch with which they deal; Insanity is equally well provided for at Gartnavel (460 beds), at Hawkhead (700 beds), at Gartloch (806 beds), and at Woodilee (1160 beds), while the City Fever Hospitals at Ruchill (540 beds) and Belvidere (680 beds) are available for the study of Zymotic Diseases. The Ear, the Throat and Nose, and the Skin are dealt with in the Western and Royal Infirmarys.

The Maternity Hospital, with every modern convenience and equipment, is situated in Rottenrow, and has accommodation for 104 patients. A new hospital for Sick Children, of greatly increased dimensions, in freer air, has been erected at Yorkhill within a short distance of the University. The beds number 200.

The Ordinance is applicable alike to men and women students, and much of the instruction is given in "mixed" classes by the Professors. There are, however, exceptions to this, some classes for women alone being held in a separate building (Queen Margaret College), and some for both sexes (in the main buildings at Gilmorehill) at different hours. Women are now admitted both to the Western and Royal Infirmarys on the same terms as men.

PROFESSORS.

Zoology—

Professor Graham Kerr, M.A., F.R.S.

Chemistry—

Professor G. G. Henderson, D.Sc., F.R.S.

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Organic Chemistry—

Professor T. S. Patterson, D.Sc., Ph.D.

Natural Philosophy—

Professor A. Gray, M.A., LL.D., F.R.S.

Applied Physics—

Professor J. G. Gray, D.Sc.

Botany—

Professor Bower, Sc.D., F.R.S.

Anatomy—

Professor Bryce, M.A., M.D.

Physiology—

Professor Noël Paton, B.Sc., M.D., F.R.S.

Physiological Chemistry—

Professor E. P. Cathcart, M.D., D.Sc., F.R.S.

Materia Medica and Therapeutics—

Professor Stockman, M.D.

Pathology—

Professor Muir, M.A., M.D., F.R.S.

Medical Jurisprudence—

Professor Glaister, M.D., D.P.H. (Camb.).

Surgery and Clinical Surgery—

Professor Sir William Macewen, M.D., LL.D., D.Sc., F.R.S.

Midwifery—

Professor Murdoch Cameron, M.D.

Practice of Medicine and Clinical Medicine—

Professor T. Kirkpatrick Monro, M.A., M.D.

Public Health—

Professor Glaister, M.D., D.P.H. (Camb.).

Pathology—

Professor John H. Teacher, M.A., M.D.

Bacteriology—

Professor Carl H. Browning, M.D.

Medicine and Clinical Medicine—

Professor Walter K. Hunter, D.Sc., M.D.

Surgery and Clinical Surgery—

Professor Robert Kennedy, M.A., D.Sc., M.D.

*Midwifery—*Professor John M. Munro Kerr, M.D.

LECTURERS.

Psychological Physiology—

Henry J. Watt, M.A., Ph.D., D.Phil.

Ear—

A. A. Gray, M.D., and J. Adam, M.D.

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Throat and Nose—

W. S. Syme, M.D., and J. Harper, M.B.

Skin—

John Wyllie Nicol, M.B., and G. M'Intyre, M.B.

Clinical Pathology—

Professor C. H. Browning.

Bacteriology—

G. Haswell Wilson, M.B., Ch.B.

Insanity—

J. H. Macdonald, M.B., and

DEAN.

Professor E. P. Cathcart, M.D., D.Sc., F.R.S.

DEGREE OF M.D.

This degree is open to holders of the M.B., Ch.B. diploma, after a period of one or two years, according to circumstances, has elapsed since the date of the latter. The requirements are (*a*) an Examination in Clinical Medicine, or in some approved department of Medical Science or Practice; (*b*) a Thesis on any branch of knowledge comprised in the examinations for M.B., Ch.B., excepting a subject which is exclusively surgical; and (*c*) a fee of £15, 15s. with an extra charge of £5, 5s. for each re-entry.

DEGREE OF CH.M.

This may be obtained on practically the same terms as the M.D. degree, the only differences being (1) that the examination is on Surgical Anatomy, operations upon the dead body, on Clinical Surgery or an approved special department of Surgery, and (2) that the Thesis must not be on a subject which is exclusively medical.

DEGREE OF B.SC. IN PUBLIC HEALTH.

Candidates must be graduates in Medicine of a University in the United Kingdom or of some other University recognised for the purpose by the Glasgow University Court, and they must thereafter have received practical instruction, including instruction in Chemistry, Bacteriology, and the Pathology of the Diseases of Animals transmissible to man, for at least twenty hours per week during a minimum period of eight months, five consecutive months of which must be in the Public Health Laboratory of the University of Glasgow. Either before or after graduation in Medicine they must also have attended, in the University of Glasgow or elsewhere, courses of Physics and Geology, and after graduation two separate courses in Public Health (Medicine and Engineering), as well as practically studying sanitary work for six months under a Medical Officer of Health in the United Kingdom, or a Sanitary Staff Officer of Health of the Royal Army Medical Corps, besides attending three months' practice of a Hospital for Infectious Diseases, where methods of administration can be studied, and three months in Mensuration and Drawing. The examinations are, *First*, Public Health, Laboratory Work, Physics, and Geology; *Second*, Sanitation, Sanitary Law, Vital Statistics, and Medicine in its bearings on Public Health. The examination fee is £6, 6s.

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DEGREE OF D.Sc. IN PUBLIC HEALTH.

Five years after obtaining the B.Sc. degree, graduates may proceed to the higher Degree of D.Sc., the requirements being (a) a Thesis or a published memoir or work to be approved by the Senate; and (b) an examination in Public Health and in such of its special departments as the Senate and University Court may determine. The fee for this degree is £10, 10s.

POST-GRADUATE MEDICAL TEACHING IN GLASGOW.

Organised Post-Graduate Medical Teaching is now available in Glasgow under the auspices of Glasgow Post-Graduate Medical Association. This Association is composed of practically all the Teaching Institutions in Glasgow, and the various Teachers giving Post-Graduate instruction, and its business is managed by a Board elected periodically by them. The Chairman of the Board is Principal Sir Donald MacAlister, K.C.B., M.D., LL.D., and the Vice-Chairman Sir Hector C. Cameron, C.B.E., M.D., LL.D.

Weekly Demonstrations for Practitioners are given throughout the Winter and Spring, and comprehensive courses of instruction during the Summer and Autumn. Arrangements have also been made whereby a limited number of graduates may become attached to Wards or Out-patient Departments nominally as Clinical Assistants for definite periods throughout the year. As such they work under the direct supervision of the Physician or Surgeon in charge, and carry out such detailed investigations as directed.

Those desiring further information should apply to Dr A. M. Kennedy, Secretary, Post-Graduate Medical Association, University, Glasgow.

QUEEN MARGARET COLLEGE FOR WOMEN.

(WOMEN'S DEPARTMENT OF THE UNIVERSITY OF GLASGOW.)

This is an integral part of the University of Glasgow. The courses regulations, and fees for the medical course are the same as for men. The instruction is given by University Professors and Lecturers appointed by the University Court, partly in mixed and partly in separate classes. The College provides a separate building, with class-rooms, laboratories, library, and other teaching appliances. The administrative offices of the Women's Department are at Queen Margaret College. The women have all the rights and privileges of University students. Clinical work is amply provided for in the Royal Infirmary and its Dispensaries, the Western Infirmary, the Victoria Infirmary, the Royal Hospital for Sick Children, the Glasgow Maternity Hospital, the Royal Asylum of Gartnavel, Belvidere and Ruchill Fever Hospitals, etc.

There are one or two small halls of residence near the College, and a list of lodgings can be obtained from the College Office.

All necessary information can be had from the Secretary to the Mistress, Queen Margaret College, Glasgow.

ST MUNGO'S COLLEGE.

St Mungo's College is contiguous to the Royal Infirmary, which is the largest hospital in Glasgow, and is situated in Cathedral Square, Castle Street. The classes are open to women students. There is car communication with every part of the city.

The College affords full courses in all the subjects of the medical curriculum. Many of the classes are recognised by the Universities of Glasgow and Edinburgh for graduation purposes. The average class fee is £4, 4s. for a Winter Course and £3, 3s. for a Summer Course. A Syllabus of Classes can be obtained on application to the Secretary to the Medical Faculty, St Mungo's College, 86 Castle Street.

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The Infirmary has, including the Ophthalmic Department, over 835 beds. There are special beds and wards for Diseases of Women, of the Throat, Nose and Ear, Skin, Venereal Diseases, Burns, and Septic Cases.

In addition to the large Medical and Surgical Departments, there are Departments for Special Diseases—namely, Diseases of Women, of the Throat and Nose, of the Ear, of the Eye, of the Skin, and of the Teeth. A fully-equipped Electrical Pavilion was opened a few years ago, and year by year the latest and most approved apparatus for diagnosis and treatment has been added. Wards are set apart for the teaching of women students.

Appointments.—Five House Physicians and twelve House Surgeons, having a legal qualification in Medicine and Surgery, who board in the Hospital free of charge, are appointed every six months. Clerks and Dressers are appointed by the Physicians and Surgeons. As a large number of cases of acute diseases and accidents of a varied character are received, these appointments are very valuable and desirable.

Fees.—The fees for (a) hospital attendance, including attendance at the Outdoor Department, at the Pathological Department, Post-Mortem Examinations, and the use of the Museum, and (b) Clinical Lectures, are as follows:—

(a) For Infirmary Attendance, Dispensary, etc.—

A. For Perpetual Ticket. £7 0 0

B. For Season Tickets—

Six months 2 2 0

Three months 1 1 0

Separate payments by a student for Season Tickets amounting in all to £7, 7s. shall, however, entitle a student to obtain from the superintendent a Perpetual Ticket in exchange therefor.

(b) For Clinical Instruction—

Two terms or six months £3 10 0

One term or three months 1 15 0

(c) Students who have paid to any other hospital in the United Kingdom or elsewhere the fees necessary to obtain a Perpetual Ticket for such hospital shall be admitted as students of the Royal Infirmary on payment of a hospital entrance fee of £1, 1s. for attendance for six months, and 10s. 6d. for attendance for three months; and where a class for clinical instruction is taken, he shall pay in addition the fees for such instruction as above stated.

THE ANDERSON COLLEGE OF MEDICINE.

DUMBARTON ROAD, PARTICK, GLASGOW.

The old Institution known as "Anderson's University" was founded by the will of John Anderson, M.A., F.R.S., in 1795, and the medical school connected therewith dates back to the year 1799.

In 1877 the name of the Institution was altered from "Anderson's University" to "Anderson's College." In 1887 the medical school of Anderson's College became a distinct Institution known as "Anderson's College Medical School."

The new buildings are situated in Dumbarton Road, adjoining the Western Infirmary and the University. They are constructed on the best modern principles, and are provided with all the appliances requisite for the conduct and management of a fully equipped medical school.

Classes are conducted in all the subjects of the five years' curriculum:—

Anatomy—Professor John Graham, M.B., Ch.B., B.Sc.

Physics—Professor Peter Bennett.

Chemistry—Professor Geo. Cruikshanks, Ph.D., F.I.C.

Botany—Professor B. G. Cormack, M.A., B.Sc.

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Zoology—Professor Peter Macnair, F.G.S., F.R.S.E.

Physiology—Professor N. Morris, M.D., B.Sc., D.P.H.

Materia Medica—Professor J. R. C. Gordon, L.R.C.S.E., L.R.C.P.E., L.R.F.P.S.G.

Medical Jurisprudence—Professor Carstairs Douglas, D.Sc., M.D., F.R.S.E.

Midwifery—Professor W. D. Macfarlane, M.B., C.M.

Surgery—Professor Archibald Young, B.Sc., M.B.

Practice of Medicine—Vacant.

Ophthalmic Medicine and Surgery—Professor W. H. Manson, M.A., M.D.

Aural Surgery—Professor James Galbraith Connal, M.D.

Diseases of Throat and Nose—Professor John Macintyre, M.B., F.R.S.E., LL.D.

Mental Diseases—Ivy Mackenzie, M.A., B.Sc., M.D.

Public Health Laboratory—Professor Carstairs Douglas, D.Sc., M.D., F.R.S.E.

Pathology—At the Western or Royal Infirmary.

Diseases of the Skin—Professor J. Goodwin Tomkinson, M.D.

Degrees and Diplomas.—Certificates of attendance on the classes at The Anderson College of Medicine are received by the Universities of London and Durham, by the Royal University of Ireland, and by all the Royal Colleges and Licensing Boards in the United Kingdom. They are also recognised by the Universities of Glasgow and Edinburgh under certain conditions which are stated in the Calendar of this school. The Public Health Laboratory Course is recognised as qualifying for the Diploma granted by the Universities of Oxford, London, and Cambridge, the Scottish Conjoint Board, and the Royal Irish Colleges.

Malcolm Kerr Bursary in Anatomy. Value about £10. Open to students of the junior anatomy class.

The Carnegie Trust will pay the fees of students at Anderson's, on conditions regarding which particulars may be obtained from The Secretary, Carnegie Trust Offices, Edinburgh.

Class Fees.—For each course of lectures (aural surgery, ophthalmology, diseases of throat and nose, mental diseases, and public health excepted), £4, 4s. For practical classes (except anatomy, chemistry, and public health), viz., botany, zoology, physics, physiology, pharmacy, and operative surgery, £3, 3s. Anatomy—Winter—Lectures, £4, 4s.; practical anatomy, £5, 5s.; summer lectures, £2, 2s.; practical anatomy, £2, 12s. 6d. Practical chemistry, £5, 5s. Public Health Laboratory—For chemistry course, £8, 8s.; for bacteriology course, £6, 6s. Ophthalmic medicine and surgery, £3, 3s.; mental diseases, £3, 3s.; diseases of the skin, throat and nose, aural surgery, £2, 2s. Medical Jurisprudence—For the triple qualification, £3, 3s.

UNIVERSITY OF ABERDEEN.

The course of study for the degree of M.B., Ch.B. extends over five years, of which two at least must be spent in the University of Aberdeen.

The curriculum is the same as in the other Scottish Universities as far as relates to attendance on University classes, to clinical study at a General Hospital, to attendance on courses of Clinical Surgery, Clinical Medicine, Mental Diseases, and Practical Pharmacy, Operative Surgery, Anæsthetics, to instruction in Vaccination, to attendance on Cases of Labour, and to the practice of a Dispensary.

The candidate must also, before admission to the final examination, produce the following certificates :—

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1. That he has been present at not fewer than twenty-five post-mortem examinations, some of which he must have personally taken part in performing.

2. That he has attended a course of instruction in Infectious Diseases consisting of not fewer than ten meetings, in a Hospital for the treatment of such diseases containing at least a hundred beds.

3. That he has attended in a Hospital a course of instruction in Gynecology consisting of not fewer than twenty meetings.

4. That he has attended in a special hospital a course of instruction in the Diseases of Children, consisting of not fewer than twenty meetings.

5. That he has attended in the Ophthalmological Department of a Hospital or Dispensary a course of instruction in Ophthalmology, consisting of not fewer than thirty meetings extending over one term.

6. That he has attended in a Public Hospital or Dispensary a course of instruction in Diseases of the Ear, Nose, and Throat, consisting of not fewer than twenty meetings.

7. That he has attended in a Public Hospital or Dispensary a course of instruction in Dermatology, consisting of not fewer than twenty meetings.

8. That he has attended a course of instruction in Venereal Diseases, consisting of not fewer than twelve meetings, in a recognised Hospital or Clinic centre for the treatment of such diseases.

Certificates for these various classes and courses must attest not only regular attendance, but also due performance of the work.

The order of study is prescribed by the Senatus and a scheme, representing the minimum curriculum, has been drawn up for the guidance of students, and is printed in the Calendar.

THE FOLLOWING ARE THE CLASSES IN THE MEDICAL FACULTY:—

WINTER SESSION.

Zoology—Professor John Arthur Thomson, M.A., LL.D.

Chemistry (Syst. and Pract.)—Professor Alexander Findlay, M.A., D.Sc., Ph.D.

Anatomy—Professor Reid, M.D., F.R.C.S.

Practical Anatomy—Professor Reid.

Physiology (Syst. and Pract.)—Professor MacWilliam, M.D., F.R.S.

Materia Medica—Professor Charles R. Marshall, M.A., M.D.

Pathology (Syst. and Pract.)—Professor Theodore Shennan, M.D., F.R.C.S.E.

Public Health—Mr John Parlane Kinloch, M.D., *Lecturer*.

Surgery—Professor John Marnoch, C.V.O., M.A., M.B., C.M.

Medicine—Professor Mackintosh, M.A., M.D.

Midwifery and Diseases of Women and Children—Professor R. G. M'Kerron, M.A., M.D.

SUMMER SESSION.

Botany—Professor William G. Craib, M.A., F.L.S., F.R.S.E.

Practical Botany—Professor William G. Craib.

Zoology—Professor Thomson.

Practical Zoology—Professor Thomson.

Physics—Professor Niven, M.A., D.Sc., F.R.S.

Practical Anatomy—Professor Reid.

Practical Materia Medica and Pharmacy—Professor Charles R. Marshall, M.A., M.D.

Physiology (Syst. and Pract.)—Professor MacWilliam.

Forensic Medicine—Professor Hay, M.D., LL.D.

Practical Hygiene and Forensic Medicine—Professor Hay.

Pathology (Syst. and Pract.)—Professor Shennan.

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Practical Midwifery and Gynecology and Clinical Diseases of Children—Professor M^cKerron.

Operative Surgery—Professor Marnoch.

Tropical Medicine—George A. Williamson, M.A., M.D.

Medical Ethics—George Williamson, M.A., M.B.

There are Assistants to all the Professors in the Medical Faculty, and also Lecturers in special departments—Chemistry (2), Embryology, Parasitology, Bio-Chemistry, Experimental Physiology, etc.

Clinical Medicine and Clinical Surgery are taught by the Physicians and Surgeons of the Royal Infirmary.

The following are recognised as Lecturers :—

Lecturer on Mental Diseases	R. Dods Brown, M.D., F.R.C.P.E., Dip. Psych.
„ Ophthalmology	{ C. H. Usher, M.B., B.S., F.R.C.S. A. Rudolph Galloway, M.A., M.B., C.M.
„ Vaccination	T. Fraser, M.A., M.B., Ch.B.
„ Skin Diseases	J. F. Christie, M.A., M.B., C.M.
„ Diseases of Ear, Throat, and Nose	{ H. Peterkin, M.B.
„ Medical Electricity	J. R. Levack, M.B., C.M.
„ Anæsthetics	{ Alex. Ogston, M.B., C.M. William Brown, M.B.
„ Dental Surgery	J. M. P. Crombie, M.B., C.M., L.D.S. (Eng.).

All the University Classes are held at Marischal College.

Tutorial Classes are held in connection with most of the Systematic Courses, and practical instruction is given in the fully equipped Laboratories connected with the several departments.

Graduates or others desirous of engaging in special study or research may be allowed by the Senatus to work in any of the Laboratories on payment of the usual matriculation fee.

General clinical instruction is obtained in the following Medical Institutions :—

The Royal Infirmary of Aberdeen.

This General Hospital, situated about seven minutes' walk from Marischal College, is constructed on the most modern principles, and is fully equipped with all the requirements for medical work and teaching. It accommodates upwards of 270 patients: the number of patients admitted during the year 1920 was 3369, and the number of out-patients treated during the same period was 14,650.

Six resident medical officers are appointed annually, three in May and three in September to hold office for twelve months. Salary, £52, 10s. with board, rooms, laundry.

Fees.—Perpetual fee to hospital practice, £10, or first year, £5, 10s., second year, £5, afterwards free; short period fees, 3 terms (one year), £4, 4s.; 2 terms, £3, 3s.; 1 term, £1, 11s. 6d.; clerkship in medicine, £1, 1s.; dresser-ship in surgery, £1, 1s.; pathological demonstrations, £2, 2s. (Special courses of lectures are charged for.)

The Royal Hospital for Sick Children

Is situated about five minutes' walk from Marischal College, and accommodates over 80 patients. The number of patients admitted in 1919 was

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914, and the number of out-patients treated was 1518. Each student must act as clerk for six weeks in the medical and surgical wards respectively.

There are two resident medical officers, who hold office for six months. Fee for hospital practice, £2, 2s. first year.

The Royal Asylum

Is about fifteen minutes' walk from Marischal College. It accommodates over 950 patients, and is fitted up with a fully equipped hospital and a laboratory.

The senior physician is recognised by the University as lecturer on mental diseases, and delivers a qualifying course of lectures.

The fee for the course is £2, 2s.

The City (Fever) Hospital

Is about ten minutes' walk from Marischal College, and accommodates 250 patients.

Senior students are admitted for instruction in fevers under the visiting physician (who is the Medical Officer of Health for the City) and his assistant. Fee, £2, 2s.

General Dispensary and Vaccine Institution.

This is about five minutes' walk from Marischal College.

The total number of cases treated during 1920 was 3659, and the number of patients treated at their own homes 929.

Fees.—General practice, £3, 3s. ; vaccination certificate and instruction, £1, 1s.

Aberdeen Maternity Hospital.

This Institution is situated at the top of Castle Terrace, less than ten minutes' walk from Marischal College. Contains 18 beds. The number of patients treated in the hospital during 1920 was 517 and at their own homes 163—in all, 680. Fee, £3, 3s.

The Eye Institution.

This Institution is situated about three minutes' walk from Marischal College. The surgeon in charge is recognised by the University as a lecturer on ophthalmology.

During 1920, 4225 out-patients were treated.

PROFESSIONAL EXAMINATIONS.

There are four examinations ; the subjects and regulations of these are common to the Universities of Aberdeen and Glasgow.

DEGREE OF M.D.

The regulations with regard to the age and other qualifications of the candidate are similar to those in the other Scottish Universities. He must submit a thesis written by himself upon any medical subject, and pass an examination in Clinical Medicine or in some Special Department of Medical Science or Practice.

DEGREE OF CH.M.

Each candidate must be not less than twenty-four years of age, and must hold the degree of M.B., Ch.B. of the University. He must produce a certificate of having been engaged for at least one year in attendance in

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the surgical wards of a hospital, or in scientific research, or in the naval and military services, or for two years in practice other than practice restricted to medicine. He must present a thesis on a surgical subject and pass an examination on Clinical Surgery, Surgical Anatomy, and Operations on the Dead Body.

DIPLOMA IN PUBLIC HEALTH (D.P.H.).

Regulations Approved by the University Court, 11th May 1920.

I.—Every candidate for the Diploma must be a graduate in Medicine of the University of Aberdeen, or of any other University whose medical degrees are recognised as qualifying for registration by the General Medical Council of the United Kingdom.

II.—No candidate will be admitted to examination until after the lapse of not less than twelve months from the date of his graduation in Medicine.

III.—The whole of the prescribed curriculum of study must be undertaken after the candidate has obtained a registrable qualification in medicine, and shall extend over not less than nine months, of which at least three months, or one academic term, must be spent in attendance at the University of Aberdeen.

IV.—Every candidate shall produce evidence of having complied with the following requirements in respect of study and training:—

(1) A course or courses of instruction consisting of not fewer than fifty meetings dealing with public health in relation to the administrative and other duties of a medical officer of health, including health and medical services and their organisation; education and propagandism; personal and environmental conditions; etiology, prevalence and control of disease; sanitary law and vital statistics—such course or courses to be given by a teacher or teachers in the department of public health of a recognised medical school.

(2) Practical instruction within a laboratory or laboratories approved by the University, in the following subjects as applicable to public health:—

(a) Bacteriology (including immunology) not less than 150 hours;

(b) Physics and chemistry—not less than 100 hours;

(c) Parasitology (including pathology of parasitic diseases) and entomology—not less than 50 hours;

such instruction to extend over not less than six months or two academic terms.¹

(3) Practical instruction, clinical and administrative, within—

(a) a hospital for general infectious diseases—not less than thrice weekly;²

¹ Rule 2 of General Medical Council, Note 2.

Alternative arrangements for British Armies in the Field. The Laboratory experience at a Base Hygiene Laboratory, when and so far as approved by the General Medical Council shall count towards the four months' Laboratory course prescribed by the Council; and Laboratory experience acquired by medical officers on the staff of hospitals for infectious diseases shall count for such part of the Laboratory course for the Diploma in Public Health as the Assistant Director for Medical Services (Sanitation) may recommend, and the General Medical Council on consideration may approve.

² Rule 4 of General Medical Council, Notes 1 and 2.

Note 1.—Methods of administration shall include the methods of dealing with patients at their admission and discharge, as well as in the wards, and the Medical Superintendence of the Hospital generally.

Note 2.—In the case of a Medical Officer of the Royal Army Medical Corps, a certificate from a Principal Medical Officer under whom he has served, stating that he has during a period of at least three months been diligently engaged in acquiring a practical knowledge of Hospital Administration in relation to Infectious Diseases may be accepted as evidence under Rule 4.

Aberdeen

(b) a hospital or sanatorium or treatment centre for tuberculosis—not less than once weekly ;

(c) a hospital or treatment centre for venereal diseases—not less than once weekly ;

such instruction in each group to extend over three months.

(4) Practical instruction and experience during not less than three months (including attendance on at least thirty working days), in the duties, routine and special, of public health administration, under the personal supervision of a medical officer of health or other medical officer, as defined in the Rules of the General Medical Council ;¹ or, alternatively that the candidate has held, within the British Dominions, for a period of not less than three years an appointment as medical officer of health of a sanitary district with a population of not less than 15,000.

(5) Practical instruction in :—

(a) Mother and Child Welfare (including ante-natal examinations) at a Centre or Centres in a Welfare Scheme conducted or approved by a Local or Sanitary Authority—not fewer than ten meetings ;

(b) School hygiene and medical inspection of school children—not fewer than six meetings ;

(c) Drawing and interpretation of plans—not fewer than six meetings.

V. The examination for the Diploma, which will extend over not less than six days, is divided into two parts, viz. :—

Part I.—Physics, chemistry, bacteriology (including immunology), parasitology and entomology, as applicable to public health.

(a) Laboratory—two days,

(b) Written and oral.

Part II.—(1) Infectious diseases (including tuberculosis and venereal diseases), etiology, epidemiology, diagnosis, specific treatment, prophylaxis, disinfection, and administrative control.

(a) Clinical,

(b) Written and oral.

(2) General hygiene.

Written and oral.

(3) Sanitary law and vital statistics.

Written and oral.

(4) Public health administration and health services.

Practical (including reports).

¹ The Medical Officers recognised for this purpose by the General Medical Council are :—

(a) In England and Wales, the Medical Officer of Health of a County or of a single or combined Sanitary District having a population of not less than 50,000, or a Medical Officer of Health devoting his whole time to Public Health work ; or—

(b) In Scotland, a Medical Officer of Health of a County or Counties, or of one or more districts having a population of not less than 30,000 ; or—

(c) In Ireland, a Medical Superintendent Officer of Health of a District or Districts having a population of not less than 30,000 ; or—

(d) In the British Dominions outside the United Kingdom a Medical Officer of Health of a Sanitary District having a registrable Diploma in Public Health ; or—

(e) A Medical Officer of Health who is also a teacher in the Department of Public Health of a recognised Medical School ; or—

(f) A Sanitary Staff Officer, of the Royal Army Medical Corps having charge of an Army Corps, District, Command, or Division, recognised for this purpose by the General Medical Council, or in charge of a Base District on Lines of Communication of a British Expeditionary Force, and holding a Diploma in Public Health or other Public Health Qualifications ; or—

(g) An Assistant Medical Officer of Health of a County or of a single Sanitary District having a population of not less than 50,000 provided the Medical Officer of Health of the County or District in question permits the Assistant Officer to give the necessary instructions and issue certificates.

Medical Education in Scotland

VI.—A candidate may enter for the examination in Parts I. and II. singly or together, subject to the condition that no candidate shall be allowed to pass in Part II. unless he has at the same or a previous examination passed in Part I. Candidates are, in general, recommended to undertake the examination in Part I. three months before presenting themselves for examination in Part II.

VII.—The fee for the examination is four guineas for each part, or eight guineas for the whole examination. In the event of a candidate failing to pass the whole or any part of the examination, a fee of one guinea is payable for each subsequent examination for which he may present himself.

VIII.—The examination shall be conducted by such Professors and Lecturers in the University and by such other persons as may be appointed for the purpose by the University Court.

IX.—The foregoing Regulations are subject to the requirements contained in the Resolutions and Rules of the General Medical Council in force at the time in regard to Diplomas in Public Health.

FEES.

Arrangements have been made, in conjunction with the other Scottish Universities, for the institution of an inclusive fee for the courses of instruction leading to the M.B. and Ch.B. degrees. The inclusive fee for instruction within the walls of the University is ninety guineas, payable in five annual instalments.

The cost of matriculation, class and hospital fees for the whole curriculum, including the fees for the degrees, is usually about £160.

Note.—Fees in the Faculty of Medicine are to be increased from between 33½ per cent. to 50 per cent., commencing Session 1921-22.

UNIVERSITY OF ST ANDREWS.

The degrees conferred are Bachelor of Medicine and Bachelor of Surgery (M.B., Ch.B.), Doctor of Medicine (M.D.), and Master of Surgery (Ch.M.). The inclusive fee for the University instruction for M.B., Ch.B. is ninety guineas; and the inclusive fee for the clinical courses is forty guineas. These fees may be paid by annual instalments. For M.D. or Ch.M. the fee payable is fifteen guineas.

Two constituent colleges of the University provide medical teaching—the United College at St Andrews and University College in Dundee. At St Andrews classes for two years may be taken, and the student may pass the first and second professional examinations at St Andrews. There are excellent opportunities for combining degrees in Arts and Science with those of Medicine. Inclusive fees have been arranged for students who wish to take advantage of these opportunities. There are many bursaries offered to students who desire to graduate in Medicine, and it should be added that the cost of rooms and of living in St Andrews is considerably less than in the larger University cities. For women, both at St Andrews and in Dundee, there are excellent residential halls provided, which are governed by the University authorities. The medical school is now carried on in buildings specially built for the purpose.

The Conjoint School of Medicine, Dundee, supplies a complete course of medical study, and the student from the United College, St Andrews, completes his curriculum there. Large new buildings with well-equipped laboratories have been provided. Both in the Medical School and the wards of the Dundee Royal Infirmary the students have unrivalled opportunities for gaining a practical knowledge of medical science and of

St Andrews

medical work, for they have individual attention and supervision which the larger schools cannot give.

The Dundee Royal Infirmary contains 400 beds, and includes special wards for obstetrics, gynecology, children's diseases, ophthalmology, dermatology, otology, and electrical therapeutics. New out-patient departments are now in use. There is a large out-door maternity department. Hospital Fees—Surgical and Medical, £3, 3s. yearly; Perpetual Ticket, £10, or in instalments, £10, 10s.; Obstetric Cases, £2, 2s.; Obstetric Clinic, £1, 1s.

Westgreen Asylum at Liff provides abundant material for instruction in mental diseases, and the City Fever Hospital in fevers. The Dundee Eye Institution furnishes cases for instruction in ophthalmology.

The Diploma of Public Health (D.P.H.) may be taken at the Conjoint School of Medicine, Dundee.

A Diploma in Dental Surgery (L.D.S.) is also granted by the University. Instruction in the University, Royal Infirmary, and Dundee Dental Hospital.

All classes in the University are open to men and women alike.

UNITED COLLEGE, ST ANDREWS.

PROFESSORS AND LECTURERS.

Physics—Professor Butler, M.A.

Chemistry—Professor Robertson.

Zoology—Professor Thomson, M.A., D.Litt., F.R.S., C.B.

Botany—R. A. Robertson, M.A., B.Sc.

Physiology—Professor Herring, M.D.

Anatomy—Professor D. Waterston, M.D., F.R.C.S.

UNIVERSITY COLLEGE, DUNDEE.

PROFESSORS AND LECTURERS.

Physics—

Professor Peddie, D.Sc.

Chemistry—

Professor Mackenzie, D.Sc., F.R.S.

Botany—

Vacant.

Physiology—

Professor Waymouth Reid, M.B., Sc.D., F.R.S.

Anatomy—

Principal Mackay, M.D., LL.D.

John Taylor, M.D., Ch.M.

Surgery—

Professor L. Turton Price, Ch.B., F.R.C.S.

Surgery, Clinical—

J. Anderson; R. C. Alexander.

Medicine—

Professor Stalker, M.D.

Medicine, Clinical—

Professor Stalker, M.D.; J. Mackie Whyte, M.D.; Professor Charteris, M.D.; W. E. Foggie, M.D.; C. Kerr, M.B.

Medical Education in Scotland

Materia Medica—

Professor F. Charteris, M.D.

Pathology—

Professor Sutherland, M.B.

Midwifery and Gynecology—

Professor Kynoch, M.B., F.R.C.P., F.R.C.S.

Midwifery and Gynecology, Clinical—

Professor Kynoch, M.B., F.R.C.S., F.R.C.P.

R. C. Buist, M.D.

Forensic Medicine—

David Lennox, M.D.

Public Health—

W. L. Burgess, M.D., D.P.H.

Ophthalmology—

Angus MacGillivray, M.D., D.Sc.

Diseases of Ear, Nose, and Throat—

R. P. Mathers, M.D.

Diseases of Children—

Professor L. T. Price.

J. S. Y. Rogers, M.B.

Diseases of Skin—

F. M. Milne, M.A., M.B., Ch.B., B.Sc.

Mental Diseases—

W. Tuach Mackenzie, M.D.

Vaccination—

Douglas Scott, M.B., Ch.B.

Fevers—

W. L. Burgess, M.D., D.P.H.

Clinical Pathology—

F. M. Milne, M.B., D.P.H.

Clinical Medical Tutors—

Drs Scott, J. M. Stalker, Malcolm, Rankine.

Clinical Surgical Tutors—

John Taylor, M.Ch. ; R. C. Alexander, F.R.C.S.E.

Anæsthetics—

A. Mills, M.D.

Bacteriology—

W. J. Tulloch, M.D.

Dean of the Faculty of Medicine—

Professor Charteris.

QUALIFICATIONS GIVEN BY THE SCOTTISH COLLEGES.

The Royal College of Physicians of Edinburgh, the Royal College of Surgeons of Edinburgh, and the Royal Faculty of Physicians and Surgeons of Glasgow, conjointly confer the Triple Qualification (L.R.C.P.E., L.R.C.S.E., L.R.F.P.S.G.). Female candidates are admitted to the examinations for this qualification.

PRELIMINARY EXAMINATION.—This examination must be passed before the student commences professional study. It may be passed before any of the Boards recognised by the General Medical Council, and enumerated in

Qualifications given by the Scottish Colleges

the Regulations of the Colleges. The Educational Institute of Scotland conducts a qualifying Preliminary examination for medical students, in Edinburgh and Glasgow, on behalf of the Colleges. This examination embraces English, Latin, Mathematics, and either Greek, French, German, Italian, or other modern language. All the subjects may be passed at one or not more than two times. Calendar, containing examination papers, can be had from Mr Hugh Cameron, M.A., 47 Moray Place, Edinburgh. Price 1s.

PROFESSIONAL EDUCATION.—The curriculum must extend over five years. Graduates in Arts or Science of any recognised University who have spent a year in the study of Physics, Chemistry, and Biology, and have passed an examination in these subjects for the degrees in question, are exempted from the first year of study. The fifth year of study should be devoted to clinical work in one or more recognised Hospitals or Dispensaries, and to the study of special diseases. For information regarding the payment of class fees by the Carnegie Trust, *vide* p. i.

ORDER OF STUDY WHICH IS RECOMMENDED.

First Summer—

Physics and Elementary Biology.

First Winter—

Five months' course in Chemistry and Anatomy; three months' course in Practical Chemistry; Practical Anatomy.

Second Summer—

Practical Anatomy and Lectures; Practical Physiology.

Second Winter—

Practical Anatomy; Physiology—Five months' course.

Third Summer—

Three months' course in Practical Pathology, Materia Medica, and Practical Materia Medica; Surgical Hospital Practice.

Third Winter—

Six months' course in Surgery and Clinical Surgery; Attendance at Surgical Wards; Anæsthetics; Pathology.

Fourth Summer—

Three months' course in Midwifery, in Gynecology, in Medical Jurisprudence and Public Health; Hospital Practice, with Clinical Instruction.

Fourth Winter—

Six months' course in Medicine; Hospital Practice, with Clinical Instruction.

Fifth Summer—

Hospital Practice, with Clinical Instruction; Insanity; Diseases of Children; Diseases of Eye.

Practical Midwifery—Three months' attendance at a Lying-in Hospital, and conduction of Twelve Cases of Labour under official supervision.

Fifth Winter—

Hospital Practice; Fevers; Dispensary; Vaccination; Skin Diseases; Ear and Throat Diseases; Venereal Diseases; Operative Surgery.

PROFESSIONAL EXAMINATIONS.—Four of these are held during the curriculum. Each is held quarterly: for the ensuing period three times in Edinburgh and once in Glasgow. Candidates may enter for all or any of the subjects at the First, Second, and Third Examinations. In the Final Examination the subjects of Medicine, Surgery and Midwifery shall be

Medical Education in Scotland

taken together at the conclusion of five Winters and five Summers of Medical Study, provided that a period of twenty-four months has elapsed since passing the Second Professional Examination; and the subject of Medical Jurisprudence and Public Health may be taken at any time after passing the Third Examination. Candidates are advised to enter for the entire examinations.

First Examination—

Physics, Chemistry, and Elementary Biology. This should be passed before the beginning of the second winter session.

Second Examination—

Anatomy, Physiology, and Practical Physiology. This should be passed at the end of the second year of study.

Third Examination—

Pathology, Materia Medica, and Pharmacy. This should be taken at the end of the third year.

Final Examination—

Can only be taken at the end of the fifth year. The candidate must have attained the age of twenty-one. It includes—

1. Medicine, Therapeutics, Medical Anatomy, Clinical Medicine.
2. Surgery, Surgical Anatomy, Clinical Surgery, Diseases and Injuries of the Eye.
3. Midwifery and Diseases of Women.
4. Medical Jurisprudence and Public Health. This can be taken any time after the Third Examination.

FEES FOR PROFESSIONAL EXAMINATIONS.

For each of the first three, £5; for the final, £15. The minimum total expense, inclusive of fees for classes and examinations, amounts to £115.

Fees for examinations in *Edinburgh* should be lodged with Mr D. L. Eadie, 49 Lauriston Place, and in *Glasgow* with Mr Walter Hurst, 242 St Vincent Street.

DIPLOMA IN PUBLIC HEALTH OF THE ROYAL COLLEGES.

The Diploma is granted by the Triple Qualification Board.

1. Every candidate for examination must hold a registrable medical qualification, which has been registered under the Medical Acts.

2. After obtaining such qualification he must have attended a recognised Laboratory in which Chemistry, Bacteriology, and the Pathology of the Diseases of Animals Transmissible to Man are taught; and the certificate must show that the candidate has conducted Chemical and Bacteriological analyses of air, water, sewage and foods, and certify that the candidate has attended not less than four calendar months, and that he has worked in the Laboratory for at least 240 hours, of which not more than one-half shall be devoted to Practical Chemistry. The following are alternative arrangements for British Armies in the field:—

The Laboratory experience at a Base Hygiene Laboratory, when and so far as approved by the General Medical Council, shall count towards the four months' Laboratory course prescribed by the Council; and Laboratory experience acquired by medical officers on the staff of hospitals for infectious diseases shall count for such part of the Laboratory course for the Diploma in Public Health as the Assistant Director for Medical Services (Sanitation) may recommend, and the General Medical Council on consideration may approve.

Qualifications given by the Scottish Colleges

3. After obtaining a registrable qualification he must during six months (of which at least three months shall be distinct and separate from period of Laboratory instruction required) have been engaged in acquiring a practical knowledge of the duties of Public Health Administration for not less than sixty working days under the personal supervision of—

- (a) In England or Wales, the Medical Officer of Health of a County or single sanitary District having a population of not less than 50,000, or a Medical Officer of Health devoting his whole time to Public Health work ; or
- (b) In Scotland or Ireland, the Medical Officer of Health of a County or District or Districts with a population of not less than 30,000 ; or
- (c) In Ireland, a Medical Superintendent Officer of Health of a District or Districts having a population of not less than 30,000 ; or
- (d) In the British Dominions outside the United Kingdom, a Medical Officer of Health of a Sanitary District having a population of not less than 30,000, who himself holds a Registrable Diploma in Public Health ; or
- (e) A Medical Officer of Health who is also a Teacher in the Department of Public Health in a recognised Medical School.
- (f) A Sanitary Staff Officer of the Royal Army Medical Corps having charge of an Army Corps, District, Command, or Division recognised for the purpose by the General Medical Council. During the continuance of the war, Base Districts on Lines of Communication of a British Expeditionary Force will be recognised.

4. After obtaining a medical qualification he must have attended for three months at least twice weekly the practice of a Hospital for Infectious Diseases, at which he has received instruction in the methods of administration.

The examination consists of two parts. The first part includes—(a) Laboratory work, with Chemistry and Bacteriology ; (b) Physics and Meteorology.

The Second Examination Embraces—(a) Report on premises visited ; (b) Examination at Fever Hospital ; (c) Examination at Public Abattoir ; (d) Epidemiology and Endemiology ; (e) Vital Statistics and Sanitary Law ; (f) Practical Sanitation.

Each examination is held bi-annually, in October and May. The fee for each is £6, 6s. ; for re-examination, £3, 3s. Fees and applications to be lodged with Mr D. L. Eadie, 49 Lauriston Place, Edinburgh ; or with Mr Walter Hurst, 242 St Vincent Street, Glasgow.

MEMBERSHIP AND FELLOWSHIP OF THE ROYAL COLLEGE OF PHYSICIANS, EDINBURGH.

Every applicant for the *Membership* must possess a recognised qualification, and be not less than twenty-four years of age. He must pass an examination on Medicine and Therapeutics, on Clinical Medicine, and on some Special Department of Medicine, such as Psychological Medicine, General Pathology and Morbid Anatomy, Medical Jurisprudence, Public Health, Midwifery, Diseases of Women, Diseases of Children, Tropical Medicine, etc. The Membership is conferred by election.

The fee for the Membership is thirty-five guineas, except the applicant be a Licentiate of the College, when it is twenty guineas.

Members of not less than three years' standing may be raised by election to the *Fellowship*, the fee being thirty-eight guineas, exclusive of Stamp Duty of £25.

The Membership and Fellowship Diplomas are now open to Women.

Medical Education in Scotland

FELLOWSHIP OF THE ROYAL COLLEGE OF SURGEONS, EDINBURGH.

Every candidate must be twenty-five years of age, and must have been engaged for two years in the practice of his profession, after having obtained a recognised qualification in Surgery. The petition for examination must be signed by two Fellows—a proposer and seconder.

The candidate must pass an examination on Principles and Practice of Surgery, including Surgical Anatomy, Clinical Surgery, and any one of the optional subjects; Surgical Pathology and Operative Surgery, Ophthalmology, Laryngology, Otology and Rhinology, Gynecology, Obstetric Surgery, Anatomy, and Dental Surgery and Pathology. The Fellowship is conferred by election.

The fee is £45, except the candidate be a Licentiate of the College, when the fee is £35. Further particulars may be obtained from the Clerk to the College, 49 Lauriston Place, Edinburgh.

The Fellowship Diploma is now open to Women.

FELLOWSHIP OF THE ROYAL FACULTY OF PHYSICIANS AND SURGEONS OF GLASGOW.

Every candidate must have been qualified for two years, and be aged twenty-four. Admission to the Fellowship is by examination and subsequent election. The candidate is examined on either (a) Medicine (including Clinical Medicine, Medical Pathology, and Therapeutics), or (b) Surgery (including Clinical Surgery, Operative Surgery, Surgical Anatomy, and Surgical Pathology); and on one optional subject—Anatomy, Physiology, Pathology, Midwifery, Diseases of Women, Medical Jurisprudence, Ophthalmic Surgery, Aural, Laryngeal and Nasal Surgery, Dental Surgery, State Medicine, Psychological Medicine or Dermatology.

The fee is £30, except the candidate be a Licentiate of the Faculty, when it is £15.

The Fellowship Diploma is now open to Women.

Edinburgh Medical Journal

July 1921

CHRONIC ARSENIC POISONING.

By RALPH STOCKMAN, M.D., Professor of Materia Medica
and Therapeutics, University of Glasgow.

CASES of chronic arsenical poisoning have occurred so frequently and in such numbers that the symptoms are now very well known, and have often been described and figured with great detail and completeness. The cases arise from prolonged therapeutical administration, from occupational causes, or from accidental poisoning. Sometimes large numbers of people have been involved, as occurred in and around Manchester in 1901 from contaminated beer, and in the neighbourhood of Hyères in 1888 from poisoned wine. In both these outbreaks it was supposed that the alcohol, or the alcoholic habits of the victims, intensified the action of the arsenic on the nervous system.

When arsenic taken into the human body in small repeated doses causes visible poisonous symptoms, its chief effects are manifested on the skin and the peripheral nerves. The colour of the skin becomes of a uniform or mottled grey, or of a light or dark shade of brown, owing to a granular deposit of pigment, and keratosis takes place on the thick portions of the soles of the feet, much less frequently on the palms of the hands and at other parts. The pigmentation most commonly begins on the lower abdomen towards the flanks, whence it spreads over the trunk, round the back of the neck, and down the thighs and upper arms, ultimately in some few cases involving the whole body. Hyperæmia at parts, branny desquamation, and warts are not uncommon, and the nails are sometimes rough and hypertrophied. The skin appearances have been described in detail by Nielsen, and their morbid histology by Brooke and Roberts.

Multiple peripheral neuritis, with all its typical motor, sensory, and trophic disturbances, is the other outstanding

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feature seen clinically. More or less motor paralysis, increased or absent knee-jerks, atrophy of muscles, tremor, hyperæsthesia, numbness, pins and needles, neuralgic pains, herpes along the course of nerves, glossy skin, falling out of hair, and excessive local sweating are some of the more prominent symptoms. Suffusion and redness of the conjunctivæ, with itching of the eyelids, and pain in the stomach, are other common occurrences, but these are seen at the beginning of the administration and pass off usually in a few days, often without any stopping of the arsenic. Other poisonous effects have been noted, but they are mostly clinical rarities, and an account of them may be found in any book dealing specially with the subject.

In spite of the numerous cases which have been reported, it is comparatively seldom that the exact amount of arsenic which has been ingested is stated or can be ascertained. In a considerable experience of clinical cases I have been much struck by the very varying tolerance shown by different individuals, and also by the irregularity with which the poisonous effects fall on the nervous system alone, or on the skin alone, or on both, or leave both untouched. The reason for this is difficult to explain, but it does not seem to have any direct connection with the amount taken, and apparently is dependent rather on individual differences in the persons taking the arsenic. The great majority of cases which I have treated with arsenic, either for long periods or with large doses, have shown no toxic symptoms, but a certain comparatively small number have come under my notice in which marked symptoms of its poisonous action have supervened, and in which I knew accurately or approximately the amount of arsenic ingested. A striking feature in these cases is the very varying amounts which were taken before any symptoms were seen, although this might have been inferred from the large number of patients who can take arsenic in considerable quantity without evincing any symptoms whatever of poisoning. From these points of view, therefore, the following cases seem to me to be of some interest.

CASE I.—Woman, aged 49, had for over six years taken thrice daily, on account of nervous excitability, a mixture of bromides with 5 minims liquor arsenicalis in each dose. This totals 32,850 minims, equal to 298 grains (19.3 grams) arsenious anhydride (As_2O_3). When seen by me there was very rough, irregular keratosis of the palms of the hands and the soles of the feet (Fig. 1), a deep mottled greyish-brown pigmentation of the whole trunk (Fig. 3),

Chronic Arsenic Poisoning

neck, thighs, and upper arms, much lighter pigmentation of the forearms and legs, with many sessile mouse-coloured warts on the chest, lower limbs, and forearms. Round about the dorsal regions of the bases of the thumbs and forefingers, and of the great toes, the skin was hyperæmic, bluish-red in colour, and very sensitive to cold or pressure. The face was of a uniform swarthy tint, not mottled; the skin on the back of the hands was very coarse, the nails were very irregular and rough, with a ragged thickened matrix projecting at the free ends (Fig. 2). The mucous membrane of the mouth and tongue had a bluish dark tint, and at the right side of the lower lip internally there was a blue-black deeply pigmented patch about the size of a sixpenny piece. The scalp was not pigmented, but she stated that her hair had lately become much thinner. She had very marked ascites (Fig. 3), and the liver dulness measured only $2\frac{1}{2}$ inches.

There was no neuritis, and no symptoms of any lesion of the nervous system. There was no anæmia, and no wasting, although she was a thin woman of very neurotic type. She stated that her general health was good, that she was quite able to do her own housework, and she applied for advice only on account of the ascites. The ascites had come on about three months previously, and she was of opinion that the pigmentation and keratosis had been first noticed by her about three years ago. She took no alcohol.

This case is remarkable, apart from the very large amount of arsenic taken, on account of the pigmentation of the mucous membrane of the mouth, and the occurrence of cirrhosis of the liver. At least I have not come across any reported cases in which these results are mentioned, and the occurrence of pigmentation in the mouth in Addison's disease is sometimes cited as a point of differential diagnosis between it and chronic arsenical poisoning. Arsenic is stored up in the liver, and it may be presumed, although it is of course not quite certain, that in this case prolonged irritation from it was the cause of the cirrhosis. Frequent abdominal tapplings were necessary, and large quantities of fluid were drawn off. The fluid was of an unusual greyish tint and contained a pigment but no arsenic. *Liquor arsenicalis* is frequently added to bromide mixtures with the idea that it prevents bromine acne. It does not do so, however, as the two drugs act on quite different elements of the skin.

In six weeks the keratosis of the palms had to a large extent disappeared, otherwise she was much *in statu quo*. Fifteen weeks after stopping the arsenic the skin of the palms was

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still thickened, the nails were much less rough, and the keratosis of the soles had considerably diminished. The face was much less dusky, and the general surface of the body was a little lighter in colour, the numerous warts showing up more clearly than before. There was still diminished liver dulness and ascites. The distal half of the left foot, which had been partly cyanosed before, was now in a very marked condition of Raynaud's disease, and very painful on walking or on pressure, as if there was a considerable degree of local peripheral neuritis. She felt no craving for the arsenic.

Death took place three months later after frequent abdominal tapplings, and without much further change in her symptoms. A post-mortem examination could not be obtained.

CASE II.—Woman, aged 29, had taken continuously for five years, on account of epileptic fits, a mixture of bromides, belladonna, and liquor arsenicalis. There were 2.8 minims liquor arsenicalis in each dose, and she took this thrice daily. It had not prevented the occurrence of bromine acne, of which there was an extensive eruption over the whole body. She had taken in all 15,330 minims liquor arsenicalis, equal to 139 grains (9 grams) arsenious acid.

The abdomen, back, flanks, neck, thighs, and upper arms were covered with a mottled light greyish-brown pigmentation; the face, forearms, and legs were free. The soles of the feet were in a condition of pronounced keratosis. There was no neuritis, or other symptoms, and her general health was excellent.

CASE III.—Woman, aged 41, had been given as a tonic a pill containing $\frac{1}{24}$ grain arsenious acid with iron and nux vomica. It did her so much good that she had continued to take it continuously twice daily for 376 days, and had thus ingested 31.3 grains (2 grams) arsenious acid. She then felt decided weakness and loss of power in her legs, and for this she consulted me. The knee-jerks were absent, she walked badly and unsteadily, felt a numbness in the right hand and thought she used it rather clumsily. On questioning her carefully it seemed probable that the earliest vague indications of something wrong had been noticeable about six months after beginning the arsenic pills, and when she had taken about 15 grains. She was treated with strychnine, massage and electricity, but her condition gradually became worse. Six months later the right hand was very feeble, the left hand fairly good, the muscles of the lower extremities and hips were much wasted, she required some assistance in walking and could not rise up from a chair. The extensor muscles of the foot were affected long before the flexors. In spite of very assiduous treatment the condition went from bad to worse, and she

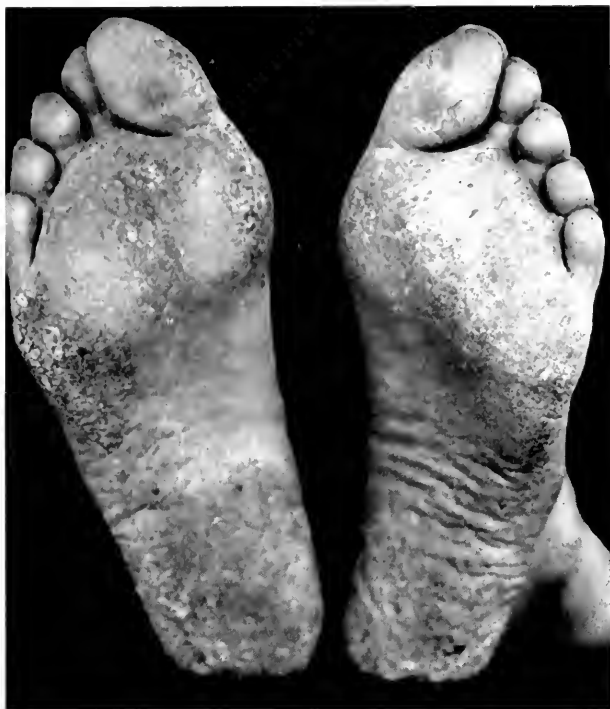
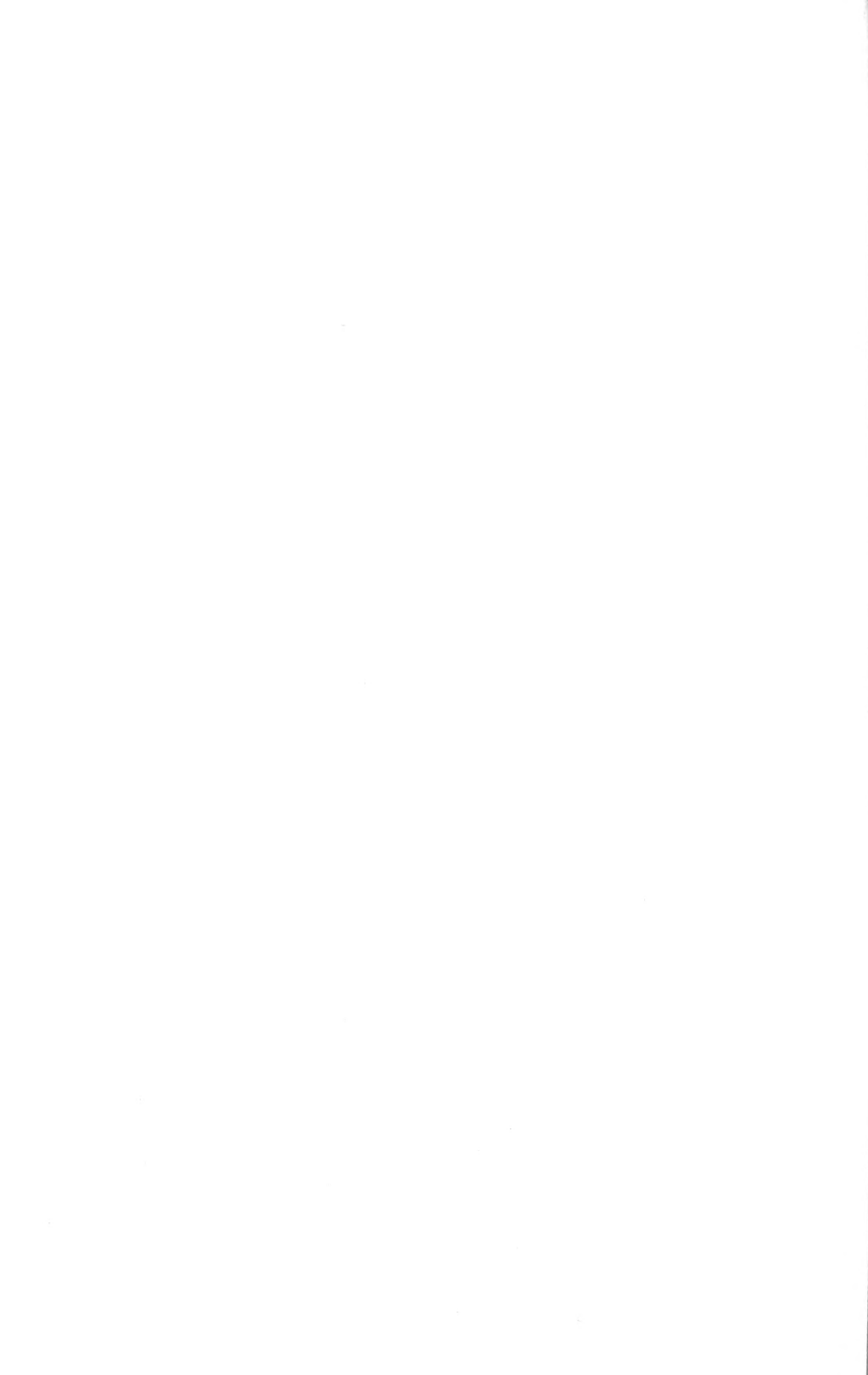


FIG. 1.



FIG. 2.



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became unable to stand or walk without a great deal of help. The arms, and especially the hands, became more useless, with drop-wrist and much wasting, the scapular muscles and deltoids also wasted, and some of the laryngeal muscles became slightly paretic. Later some contracture occurred in the hands. Certain of the muscles in the upper and lower limbs responded to the faradic current, others did not. Owing to the peripheral paralysis it was impossible to investigate the condition of the spinal cord. For two years now her condition has remained stationary, and there seems to be no prospect of improvement.

During all the time her skin remained perfectly white and smooth, and she had no other symptoms of arsenical poisoning beyond those described.

CASE IV.—Man, aged 52, suffering from Hodgkin's disease (lymphadenoma), had taken for four years, with some intermissions, liquor arsenicalis in doses of 5 to 12 minims thrice daily. It was impossible to arrive at the exact amount actually taken, but it approximated to 23,000 minims, equal to 209 grains (13.4 grams) arsenious anhydride. He had extensive mottled brown pigmentation of the whole trunk, neck, thighs, and upper arms. There was marked keratosis of the soles of the feet and slight keratosis of the palms. There was no neuritis, and no other symptom of arsenical poisoning.

CASE V.—Woman, aged 42, a marked case of myxœdema with deep anæmia. She was treated with dried thyroid and got in addition 10 minims liquor arsenicalis thrice daily for sixty-four days, equal to 1920 minims liquor arsenicalis or $17\frac{1}{2}$ grains (1.13 grams) arsenious acid. She had at first conjunctivitis and a "silvery" tongue, but these soon passed off, and she gradually developed marked pigmentation of the abdominal wall and slight pigmentation of the upper parts of the thighs and arms. The soles of the feet and the skin over the knees were keratosed. She had a feeling of tightness and numbness in the legs, and increased knee-jerks. On stopping the arsenic the symptoms all passed off in about three weeks.

CASE VI.—Man, aged 56, suffering from cancer of the stomach and severe anæmia, was given liquor arsenicalis, 5 minims thrice daily for forty-five days, equal to 6.1 grains (0.39 grams) arsenious acid. His flanks and neck became deeply pigmented, and the skin of the abdomen slightly so; there was slight keratosis of the soles of the feet, and pain and tenderness along the posterior tibial nerves with increased patellar reflexes. The keratosis cleared off in fourteen days after the arsenic was stopped, and the other symptoms a little later under treatment.

CASE VII.—Man, aged 35, suffering from pernicious anæmia, took during thirteen months 5500 minims liquor arsenicalis, equal to 50

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grains (3.2 grams) arsenious acid. He gradually developed marked keratosis of the soles of his feet, and very slight pigmentation of the skin of the abdomen and trunk, along with a few brownish warty excrescences. There was no neuritis and no other symptom of arsenical poisoning.

CASE VIII.—Man, aged 33, a very chronic case of pernicious anæmia, got in forty days 310 minims liquor arsenicalis per os and 180 minims hypodermically. He had had no arsenic for several months previously. This is equal to 4.4 grains (0.28 grams) arsenious acid. He developed a slight general brownish darkening of the skin of the flanks with very numerous deeper brown spots over the whole abdominal wall. There were no other symptoms.

CASE IX.—Man, aged 27, suffering from a first attack of pernicious anæmia of slight severity, after taking 5 minims liquor arsenicalis thrice daily for fifty-three days, 795 minims in all, equal to 7.2 grains (0.46 grams) arsenious acid, was observed to have gradually developed a deep brown pigmentation of the skin of the abdomen, flanks, hips, legs, neck, and face. The skin was rough and hyperæmic generally, and there was a number of small deeply pigmented flat warts on the legs. He had no other symptoms and no neuritis, and in ten weeks the brown colour had entirely faded.

CASE X.—Man, aged 48, was treated for pernicious anæmia with liquor arsenicalis over a period of six years before coming under my observation. There had been intermissions in giving the arsenic, but during that time he had taken, as nearly as could be ascertained, about 22,000 minims, equal to 200 grains (12.8 grams) arsenious acid.

When I saw him there was a regular uniform deposit of deep brown pigment in the skin of the flanks, thighs, neck and elbows, with very rough keratosis of the soles of the feet. But he was also suffering from severe peripheral neuritis. The posterior tibial nerves were very tender on pressure, there was drop-foot, the great toes were completely paralysed, and there was some contracture of the calf muscles, on account of which he could neither stand nor walk. There was glossy skin and absence of hair on the lower half of both legs, and excessive sweating of the hands and feet. The grasping power of the hands was very feeble, there was much wasting of the interossei and other small muscles, and marked glossy skin, with very decided tremor when he used his muscles.

CASE XI.—Man, aged 56, after an attack of pernicious anæmia nearly two years previously, had during fifteen months taken continuously 4 minims liquor arsenicalis twice daily. This amounts to 3600 minims, equal to 32.7 grains (2.1 grams) arsenious acid. At the end of the fifteen months the skin of the abdomen, flanks, and thighs



FIG. 3.

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showed a uniform light brown pigmentation, the palms and soles were moderately keratosed, and his posterior tibial nerves were abnormally painful to pressure. The knee-jerks were not affected. The arsenic had not prevented the occurrence of a serious relapse.

CASE XII.—Girl, aged 12, suffering from chorea, was treated with 15 minims liquor arsenicalis thrice daily for thirteen days, when it had to be stopped for three days owing to vomiting and irritation of the eyes. She then resumed it in 10-minim doses thrice daily for 22 days without any discomfort. It was then noticed that she was not walking well owing to a slight degree of drop-foot. Flexion of the foot was perfectly strong, but the extensor muscles were feeble. The right foot was much worse than the left. The knee-jerks were absent and there was pain on pressure over the posterior tibial nerves. There was no pigmentation or roughness of the skin. She had taken 1245 minims liquor arsenicalis, equal to 11.3 grains (0.73 grams) arsenious acid. The arms were not affected, and the legs did not become any worse. She was treated with massage and electricity, and recovery was complete in eight weeks.

The amounts of arsenious acid in grains taken in these cases are respectively, 298, 139, 31, 209, $17\frac{1}{2}$, 6, 50, $4\frac{2}{5}$, $7\frac{1}{5}$, 200, $32\frac{7}{10}$, $11\frac{1}{3}$, but the degrees of poisoning are very far from being proportional to the dosage. When one consults the writings of practitioners who have had wide experience in giving arsenic, instances are met with where very large amounts have been taken without injury of any kind. Hunt relates the case of a young woman suffering from lupus who took 5 minims liquor arsenicalis thrice daily with very little intermission for eight years without the slightest damage to her health. This is about 398 grains arsenious acid (25.7 grams). He also says, "I have now administered arsenic to patients in small but efficient doses for months or years together, in many thousands of cases, and have watched in vain for the alarming symptoms attributed to its use." But he mentions as signs of overdosing, prickling and redness of the eyelids, tenderness in the soles and palms, followed by thickening of the epidermis, and darkening of the skin with pityriasis and a papular eruption. Gowers has stated that the smallest quantity which he had ever known give rise to pronounced pigmentation was equivalent to about 100 grains (6.4 grams) arsenious acid taken during two years as liquor arsenicalis (11,000 minims), and that he had never seen arsenic cause neuritis. On the other hand, O'Flynn records pigmentation in

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a boy of ten years after getting 330 minims liquor arsenicalis in three weeks (3 grains As_4O_6), and Buzzard has observed neuritis after 13 grains (0.84 gram) had been taken in fifty days (1430 minims liquor arsenicalis). Turner habitually gave large doses in malaria without any bad effects, as much as 2090 minims liquor arsenicalis in twenty-eight days (equal to 19 grains or 1.2 grams arsenious acid). To cut short a paroxysm he often gave 30 minims of liquor arsenicalis every two hours until four doses had been taken. Cheadle records the treatment of 167 cases of chorea with liquor arsenicalis up to doses of 12 minims thrice daily, and says the only ill-effects seen were disturbances of digestion, darkening of the skin in four cases, and albuminuria in two cases. Sawyer gave up to 60 minims thrice daily to a girl with chorea.

But the most famous consumers of large doses of arsenic are the Styrian peasants who continue the practice for a lifetime without developing any signs of chronic poisoning, some of them swallowing from one to several grains daily. Nevertheless, it is said that the dose must be carefully adapted to each individual constitution by slow and cautious increase, otherwise symptoms of acute poisoning ensue. It is also said that abrupt abstinence in these people is followed by physical and mental discomfort, which is allayed by a further indulgence. Jonathan Hutchinson, however, says he has never seen any craving established, and that patients long accustomed to its use leave it off willingly and without harm. Mathieu relates the case of a man who for over twenty years had consumed daily 3 to 4 centigrams. sodium arseniate without any apparent effect; but then, on rapidly increasing the dose, he suffered from gastro-enteritis, pigmentation, keratosis, and neuritis. It looks as if the limits of natural or acquired tolerance were easily overstepped, and this case seems to bear out what is related of the Styrians in this respect.

Heisch gives an instance of the manager of an arsenic mine, who, beginning with 3 grains daily (0.19 gram), took up to 23 grains arsenious acid (1.4 gram) daily without bad effects. He tried on two occasions to give up the habit, but each time suffered from faintness, palpitation, depression, incapacity for exertion, insomnia, and pneumonia. He made no further effort, owing to his fear of another attack of pneumonia. It is interesting to note in this connection that Dr Parkes Weber has reported 5 cases of pneumonia in children who were taking

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arsenic. Heisch mentions other large quantities consumed habitually, and instances a man in Lincolnshire who took liquor arsenicalis without harm in a dose equivalent to 5 grains arsenious oxide daily for six years, or about $1\frac{1}{2}$ lbs. in all. In this connection also, an experiment by Cloetta is of very great interest. Beginning with small doses he gradually accustomed a fox-terrier dog to take arsenious acid by the mouth up to 2.5 grams daily (39 grains), and in twenty-one months it had swallowed a kilogram, and yet remained quite well. He says that the bowel ceases to absorb the arsenic except in very small quantity, as only fractional amounts (6.2 mgrms. after 2.5 grams) were latterly found in the urine, and he thus explains the tolerance of his dog and of the Styrian arsenic-eaters. Further, he says no real systemic immunity is established as his experimental dog succumbed to 40 mgrms, (the minimum lethal dose) given subcutaneously. But considerable amounts of arsenic have been recovered from the urine of Styrian arsenic-eaters, and it must therefore have been absorbed from the bowel, while Besredka, as the result of an experimental research, attributes the tolerance to the formation of an antibody in the blood. The records of chronic poisoning in man also show that in some cases at least it is absorbed in considerable quantity, while the large amounts tolerated in other cases seem to bear out Cloetta's contention. Drinking water containing arsenic is said to affect strangers, but not those accustomed to its use. Davy, for instance, describes a small stream in Cumberland containing about 1 mgrm. per litre of arsenious oxide, which forms the water-supply of a small hamlet. It does no harm to man, or to other animals except ducks, which cannot be reared in its neighbourhood as they emaciate and die, nor do fish live in it. That comparatively small doses of arsenic may bring on marked changes in the skin and nervous system is, however, proved by a few published cases, including some of those cited in this paper. Railton has recorded the exact dosage in 4 cases where girls, aged ten to twelve years, all suffering from chorea, developed marked peripheral neuritis in the arms and legs within one to four weeks after swallowing comparatively small quantities. The recovery in all was good but tedious. One of them showed in addition roughness of the skin, another desquamation, some disturbance of digestion, and red, watery eyes. The total amounts of arsenic taken were (1) 630 minims

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liquor arsenicalis in twenty-one days (5.7 grains, or 0.36 grams As_4O_6); (2) 840 minims in twenty-eight days (7.6 grains, or 0.49 grams); (3) 810 minims in twenty-one days (7.3 grains, or 0.47 grams); (4) 810 minims in twenty-four days.

In considering these observations certain questions of practical importance emerge.

(1) If Cloetta's observation is correct, that solid arsenious acid ceases to be absorbed from the bowel except in very minute quantity after it has been administered per os for some time, it must lose a great deal at least of its systemic action as a result of prolonged therapeutical administration. There are no experiments of the same kind on the lower animals regarding the absorption of liquor arsenicalis or other soluble preparations, but the cases recorded by Heisch and many therapeutical experiences show very conclusively that large amounts of liquor arsenicalis can be safely tolerated. It is very desirable in the interests of patients who have to take arsenic for long periods, that the whole question of tolerance, and of absorption or non-absorption from the bowel, should be put on a much more certain basis than it is on at present.

(2) The administration of arsenic compounds may be safely continued for a considerable period after pigmentation of the skin and keratosis have developed. If slight, these clear off rapidly after the administration is stopped, and seem to leave no ill effects. Very deep pigmentation may be permanent, and in a few cases the development of cancer has been noted, apparently following upon local irritation.

(3) On the other hand its administration should be stopped at once as soon as the slightest signs of neuritis appear. The lesion is always tedious and troublesome to get rid of, and in some cases is permanent.

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"CARDIOSPASM," CONGENITAL NARROWING OF THE ŒSOPHAGUS AND ŒSOPHAGECTASIA.

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(Continued from p. 347, vol. xxvi.).

II. CONGENITAL NARROWING OF THE ŒSOPHAGUS.

IT must have come under the notice of every observant person that there is a disparity in the ease with which different people swallow food. Remembering how certain individuals, who can swallow without thought the ordinary bolus, find it difficult or impossible to swallow a pill; and recognising that this inability is entirely a nervous disqualification, it is not to be wondered at if nervous instability be too readily accepted as the cause of all dysphagias where organic disease is not in evidence. But fuller consideration cannot fail to suggest that mere nervousness cannot be a satisfactory explanation of every non-pathological difficulty or delay in deglutition. An inconvenience to the individual, it is not fraught with danger to life, and perhaps on that account its significance has been overlooked and its importance underrated.

"Congenital narrowing of the œsophagus," writes Ballantyne,⁷ "with or without the œsophageal diverticulum, constitutes an anomaly which cannot be absolutely affirmed to be ante-natal in origin unless it be met with at birth, and since it does not prevent post-natal life (as does imperforation of the œsophagus), it is seldom that it is discovered at an early age." This is a somewhat misleading paragraph. Œsophageal diverticulum and congenital narrowing are two distinct anomalies in no way interdependent; and the recognition of constriction of the œsophagus in infancy depends not on its presence but on the degree of obstruction. The great majority of congenital narrowings cause no symptoms as long as the diet is fluid, and especially if the infant, breast-fed, has its natural and most suitable food. Should the constriction be extreme, even in infancy symptoms will follow, while with a less degree of constriction the existence of the anomaly will be noticeable only later in life, and dysphagia arise at less frequent intervals.

My attention was first seriously attracted to this condition

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by the following case, which fortunately was an unusually severe one:—

CASE III.—Jessie was aged 12 years when she first came under my observation in August 1908, suffering from recurrent vomiting which had existed since infancy. She was the third child of a family of six. Her parents were well and normally developed, and the other children were well grown and each was healthy, though on a younger sister I had operated for a myeloma of the lower gum. Jessie was brought up on the breast only, till nine months of age. Almost immediately after birth she began to vomit occasionally, and this became more noticeable as she reached four or five months old. Her parents considered that it was on account of her difficulty in feeding that she did not grow as her brothers and sisters did. She walked at fifteen months. After the age of nine months she had skimmed milk added to her diet, and was given bread which had had boiling water poured over it, and the breast-feeding was gradually omitted. Any other diet brought on vomiting. With the vomiting she was never nauseated, and at meal times would take a little food, vomit it, and return at once for more. She had never at any time been able to take solid food. No pain ever preceded her vomiting nor accompanied her attempts to swallow. She could take liquid or thin soup, but milk was always her staple article of diet. Her parents recognised this and did not desire the child to be present at meals, but left instructions at a neighbouring dairy to give Jessie drinks of milk whenever she should ask for it, and in that way the child gained her sustenance. She was in hospital for a few days in 1900, and the condition, superficially investigated, was ascribed to gastric catarrh. Four years later, at the age of 9, she was again in a hospital and under observation for two months, and the illness ascribed to "habit vomiting." At this time an act, which in a younger or more sensitive child would have been one of peculiar brutality, was perpetrated on her. She was taken to another ward and shown a negro in bed, and told that if she vomited again she would be put to sleep with the "black man." The child prevented the threat being carried out by getting paper when she could—for she was allowed up in the ward—and picking out all the solids from her food, she wrapped them in the paper and surreptitiously disposed of them when she went to the lavatory. During this period of rest in hospital she gained 8 lb. in weight. At the age of 12 years she was a bright, healthy, active, and exceptionally intelligent child. She never vomited between meals. Any food not ingested came back exactly as it was taken, unaltered, not soured, but mixed with saliva, not containing mucus, and never containing blood. Nevertheless she was under-sized and under-developed, which perhaps made her intelligence and smartness the more striking. A photograph taken at this time standing alongside



The subject of the Congenital Narrowing of the Œsophagus
has her sister, three years her junior, standing on her right.



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her sister, who was two years and eleven months her junior, conveys a better idea of her development than any description can. Under an anæsthetic the smallest size of œsophageal bougie was arrested at ten inches from the dental margin. A radiogram showed an elongated shadow in the region of the lower half of the œsophagus with a barium meal. If powdered biscuits were omitted from the mixture, and only barium and milk given, the fluid passed the stricture into the stomach, where it gathered as the usual rounded shadow in the left hypochondrium. Jessie was under my observation in the ward at that period during five months, and increased from 3 st. 5 lb. to 4 st. 2 lb., and for six months after her discharge she maintained this weight. For years I kept her under occasional observation. She passed through school creditably, and then became a worker in a mill, but at no time was she able to extend her diet beyond absolute fluids.

Were all cases as pronounced as this one, there would be little difficulty in persuading even the most prejudiced of the existence of congenital narrowing of the œsophagus. In accordance with all congenital defects, every degree is found. It requires little imagination to believe that had Jessie's malformation been a little more decided, it would have been incompatible with life; as it was, it seriously interfered with growth, and a condition which might be called “œsophageal infantilism” resulted.

In such a case as this, spasm would never be thought of; yet had it been less definite, spasm would certainly have been suggested, and by some most illogically insisted on. Its very severity puts it out of that category.

If cases of congenital narrowing of the œsophagus are rare, cases where the defect is noticed in infancy are rarer. The narrowness must be indeed extreme if regurgitation occurs before weaning brings about a change of diet and the ingestion of more solid food. Dunn⁸ has recorded the case of a boy aged 18 months in whom an obstruction could be felt by bougie $7\frac{1}{2}$ inches from the teeth. Solid food was returned at once, but small quantities of fluid could be retained. A gastrostomy was performed, the stomach was found small, and by and by dilatation from below was attempted through a fresh gastrostomy opening. The child developed bronchopneumonia and gradually became emaciated and died, and post-mortem examination discovered a marked diminution in the size of the œsophagus at a point an inch above the diaphragm. Rogers⁹ records a very similar case of a male

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child aged 22 months who was reported to have taken food well during the first ten months of life. An œsophageal tube could not be passed. The child lost weight rapidly, became bronchial, and died. Post-mortem examination "showed a fairly tight stricture about an inch from the lower end of the œsophagus."

Who could doubt that these two cases were congenital in origin? "Stricture" is the term used in each, but "stricture" is an objectionable word in that it conveys the idea of an inflammatory attack followed by pathological changes. Surely "congenital narrowing" would be less exceptionable. No philological objection could be raised to "stenosis" as descriptive of the condition, but I have avoided that term because it is apt to suggest a degree of contraction or closure which is only associated with the extremes of narrowing.

A very similar case to the one I have described is recorded by Whipham and Fagge¹⁰ of a female child of 4 years in whom vomiting had occurred from six months of age. Here, as in most other patients, the trouble began when weaning brings about a change in food. The child would eat greedily, and after three or four mouthfuls would say she was going to vomit, and without nausea would eject what she had swallowed. A bougie was arrested at the lower end of the œsophagus, while a No. 2 or 3 catheter passed easily into the stomach. Attempts to dilate the stricture caused perforation, and the child died three days later. Post mortem a fibrous stricture was found three-quarters of an inch below the bifurcation of the trachea. It was white, thick, and firm, and unlike the rest of the œsophagus. There was a perforation below the epiglottis, mediastinitis and right pneumothorax. I suggest that the changes in the œsophageal wall were the result of the interference.

"Narrowings are the most frequent and clinically the most important of the affections of the œsophagus," wrote Zenker in von Ziemssen's *Cyclopedia of Medicine*¹¹ nearly half a century ago, and he pointed out that there are stenoses which from their anatomical structure (a perfectly healthy condition of the tissues and no trace of scars), as well as from their history, must be considered congenital, but which, in spite of considerable narrowing of the tube, might permit of a prolongation of life even to old age. These facts are well illustrated by the following case:—

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CASE IV.—In 1912, a few days before her death at the age of 82, I was asked to see Mrs S. because of her inability to swallow. In 1904 she had developed an ill-defined paresis, probably from atheromatous or senile changes in the cerebral blood-vessels. She was somewhat deaf and too ill to give any account of her symptoms. No tumour could be made out, nor were there any glandular enlargements. Her development was good and there was no emaciation. The smallest size of œsophageal bougie could not be passed through a stricture about the cricoid level. The provisional diagnosis was carcinoma. It was a surprise, therefore, on post-mortem examination, to find at the cricoid level a narrowing of the œsophagus through which only with difficulty could a small probe be passed. On this as a guide, the œsophagus was divided vertically, and examination then showed that all the coats were represented and all were normal. Each layer, mucous, sub-mucous, and muscular, was without any difference from the same layer in any other part of the œsophageal tube. Her relatives informed me that she had never been able to take any solid food, that she herself had declared that she had *all her life* had a narrow swallow, and had never been able to take food like other people. It was within their knowledge that she took only liquids, and that she had to swallow with slowness and care. Probably her death was due to senility, and only the senile weakness of the muscles and their enervation brought the lifelong dysphagia into unwarrantable prominence. As long as consciousness remained she was able to swallow liquids, but with the disturbance of consciousness she became unable to exercise the necessary care. This case affords other important points. There was no hypertrophy of adjacent parts, there was no dilatation, the anatomical parts were absolutely well developed and normal *except* that at the cricoid level for about an inch the calibre of the œsophagus was very greatly restricted.

This case also shows that congenital narrowing is not limited to the lower end of the œsophagus. Indeed, though, as would be expected, more common at either extremity, no part of the tube is exempt from this congenital defect.

Sir Everard Home¹² records the case of a lady of 46 who came under his observation. She had “from her earliest remembrance had a narrow swallow,” which had given more trouble during the preceding two years. She had “attacks threatening suffocation,” in one of which she died. The orthopnœa was evidently in association with the extensive disease of the right lung which was found on post-mortem. The œsophagus immediately behind the cricoid was contracted. There was no thickening, and the stricture, Home says, consisted

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of a fold of the internal membrane only. The specimen is in the museum of the Royal College of Surgeons of England (No. 2296), and it is noted in the descriptive catalogue that "no trace of stricture can now be seen." It is curious to see the specimen after so many years (Home's book was published in 1803) still blackened by nitrate of silver, the application of which Home claimed to be the successful treatment of such strictures.

There are other specimens of narrowing of the œsophagus in the Royal College of Surgeons' Museum, and a few I have examined in other London museums, but there is a lack of evidence or history that would prove their congenital origin, but at the same time there is also a lack of proof of later acquisition. Another difficulty than want of previous history in collecting cases on which to base a justifiable conclusion is the want of sufficiently prolonged observation. Butlin,¹³ after referring to the rarity of chronic obstruction to swallowing in young people, tells of a boy of 11, whose mother stated "that never in his life had he been able to swallow solid food." He was well nourished and well developed. Under an anæsthetic Butlin passed a bougie. "About the middle of the œsophagus," he writes, "it seemed to encounter some hindrance, and overcoming that hindrance by a little pressure I passed it into the stomach." While stupid with the anæsthetic the boy swallowed a lump of bread, but refused to attempt such a thing when he regained his senses. Butlin believed he had broken down a congenital diaphragm in the œsophagus. In the same paper he records a second case—that of a girl of 15, emaciated and under-developed, with a history that she had never been able to swallow solid food, and even fluids she swallowed with difficulty. An attempt to get in œsophageal tubes had to be abandoned, but the attempt seemed to have done good, for gradually thereafter the power of swallowing returned until she was able "to take food like any other child." Butlin again believed that he had broken down a congenital web, and that the child was practically cured. In a short reference to congenital stenosis of the œsophagus, Kirmisson¹⁴ quotes a case on the authority of Mayer of New York, of a female aged 9 years, who from birth frequently regurgitated milk along with quantities of stringy mucus. The vomiting was unaccompanied by any abnormal contractions. "The sound revealed a marked stenosis in the lower part of the œsophagus." After three months of progressive dilatation the

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child could take solid food, and at the end of a year was “restored to normal health.”

Butlin's idea of a congenital web was of course not original. It was an old suggestion, promulgated before the ontogenesis of the œsophagus was known, and doubtless stimulated by the clinical observation of the less varieties of imperforate anal canal in which the meconium shows through a safely incised membrane. In more modern times the occurrence of narrowings or diaphragms have been described as being present in other parts of the alimentary canal, but in association with foetal structures or at the junction of morphologically separate units, and it did not need the title of Home's monograph, “Practical Observations on the Treatment of Strictures in the Urethra and in the Œsophagus,” to suggest a relationship between these two canals. If there were any similarity, however, between web-obstruction in the œsophagus and in the urethra, a paper by Young, Frontz, and Baldwin¹⁵ would dispel the illusion. In their paper entitled “Congenital Obstruction of the Posterior Urethra,” they describe in their “Case IV.” a thin, fibrous-looking membrane at the apex of the prostate, attached to the entire circumference and forming pockets with their concavity towards the bladder, and this they allege bringing about hypertrophy of the bladder, dilatation of the ureters, and hydronephrosis. Were there any analogy one would expect some proximal hypertrophy in œsophageal web-obstruction, whereas such overgrowth is unknown either in web-obstruction or congenital narrowing.

The analogy between the œsophagus and the pylorus is so erroneous and misleading that the advisability of even mentioning the two together seems almost unjustifiable, but the deduction drawn from urethral obstruction may be amplified by reference to a communication on congenital pyloric stenosis by Cautley and Dent.¹⁶ They figure in the obstructed pylorus a longitudinal fold of the mucosa. To this fold the writers attribute a causative importance which the experience of other observers has not confirmed, but it is not illogical to infer that were that longitudinal fold the cause of the obstruction, a web-fold in the œsophagus ought to be associated with equal hypertrophy to the pylorus; and further to induce, that if the longitudinal fold were secondary to the pyloric obstruction, a web-fold in the œsophagus might have some causal relation with that congenital narrowing which is so frequently

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noted as being present along with the so-called "congenital web."

About the third week of development of the embryo the human œsophagus is merely an annular constriction between the pharynx and the stomach, and it is only with the differentiation of the neck that elongation takes place. Were, as a result of mal-development, some of this constriction to remain, it is conceivable that something of the nature of a diaphragm might remain (though an areal and not a horizontal linear constriction is much more conceivable), but I do not think that such a diaphragm would consist of internal coat only. If the "web" caused appreciable obstruction, undoubtedly the œsophageal muscle proximally would alter its normal condition by becoming hypertrophied.

There is a Hunterian specimen in the Royal College of Surgeons' Museum (No. 2294) in London which is described as "part of the pharynx with larynx. Opposite the lower margin of the cricoid cartilage there is a projecting annular fold of mucous membrane about a line in depth, narrowing the passage into the œsophagus. The adjacent parts appear healthy, and the fold is composed of healthy mucous membrane. The canal around the fold is slightly constricted." The origin of the fold may be as suggested, but the information about the specimen and its origin is insufficient to justify speculation. It is to be noted that the fold is at the entrance to the œsophagus, and is not associated with either inflammatory changes or hypertrophy.

The specimen exhibited next to this one in the same museum is again from the collection of Sir E. Home (No. 2295). It is from a child, and "at the level of the lower margin of the cricoid cartilage, the commencement of the œsophagus is reduced to less than half its natural diameter by a sudden contraction of its walls. The tissues at and around the stricture *are not visibly altered, and the canal above and below it is healthy.*"*

Home mentions that of cases of œsophageal dysphagia which came under his notice: four were in ladies of delicate constitution who had noticed a difficulty in swallowing before 17 years of age, and that this difficulty had increased at the age of 40. That is not to be wondered at, for as the resiliency of youth passes off the œsophagus, in common with other passages, becomes less distensile and the general musculature less active.

Under the title "Simple Stenosis of the Gullet," Sir Morell Mackenzie¹⁷ includes consideration of cases which present

* My italics.

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“abnormal narrowness of a limited portion of the œsophagus without any morbid change in any of its component tissues at the seat of stricture.” To the few references he has collected he adds no case of his own, so that his conclusions, drawn from information and not from observation, lose considerably in value. His definition is excellent, but he lacks consistency when he includes under “simple stenoses” cases of partial paralysis and dilatation. All the same, it is obvious that this authority recognised the existence of true congenital narrowing of the œsophagus.

In a paper dealing with carcinoma of the post-cricoid region and upper end of the œsophagus, Logan Turner¹⁸ states that out of thirteen men and eighty-one women suffering from this condition, four women “stated that as long as they could remember they were obliged to eat slowly, explaining the fact on the ground that they had ‘a narrow throat.’” If these were cases of congenital narrowing of the less degree, almost 4 per cent. seems a very high ratio amongst cancer; but it must be remembered that carcinoma tends to occur at points of irritation as well as at the junction of heteromorphological areas, and certainly deglutition will cause more irritation at a point of congenital narrowing than in a normally distensile tube. Indeed, in this relation Logan Turner writes: “It is now the experience of many laryngologists that a considerable proportion of the women who suffer for a number of years from *spasmodic* difficulty in swallowing, eventually develop carcinoma in the laryngeal part of the pharynx.” I would take exception to the term “spasmodic difficulty” used here by Logan Turner. What these patients really complain of is “intermittent difficulty,” and the laryngologist, without realising that he is approving a theory, dubs it “spasmodic.”

The following case illustrates one of the minor degrees of congenital narrowing:—

CASE V.—David W., a draper, aged 68, stated in 1912 that he had “naturally a narrow gullet and had been sensible of that all his days.” He could not recall any particular occasion when his usual care in swallowing had been followed by any untoward event until about 1897, when, while eating a tough rabbit, a portion had stuck in his gullet. A medical man was sent for, but before he arrived relief was obtained by the bolus passing into the stomach. A stomach tube, however, was passed, more to justify the doctor’s visit than to relieve the patient’s necessity. Some years later the inability to swallow easily

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caused him to consult Dr Malcolm, who regarded the condition as functional. In 1907 he was eating a variety of stone fruit known as "Victoria Plum," and turning his head sharply to make a remark he swallowed a stone. He felt the stone "somewhat tight in going down." As he had finished eating he did not swallow anything more that night, but went to bed as usual, and next morning he rose to take his breakfast. He found, however, that he could not swallow anything, nor was he able to swallow at all during the entire day, and by night he was prostrate with exhaustion. During the subsequent few weeks his food consisted entirely of milk and cod-liver oil, poached eggs, and pease-meal brose. In January 1908 he was examined successively by three surgeons. Two of these attempted to pass an œsophageal bougie, but each found a distinct obstruction preventing its entrance to the stomach. He was told that he had cancer of the gullet, and that his emaciation and exhaustion made him unsuitable for surgical interference. The obstruction continued during one year and ten months, when he rose one morning to find the obstruction gone. He began to eat, and was astonished to find he could swallow anything, though of course he resumed the usual care which had characterised his eating during his entire lifetime. In 1914 he continued well, though he had to be careful with dry food as he had always had to be.

The lifelong necessity for care in swallowing seems sufficient proof of congenital origin in this case. The absence of discomfort when the blocking occurred surely eliminates spasm, and to my thinking the duration of the obstruction during sleep and waking and its sudden relief is incompatible with muscular contraction.

CASE VI.—Before the days of radiography a child, aged 3 years, was admitted to hospital with vague symptoms of chest trouble. He objected to lying down and had a slight rise of temperature, but took the fluid and semi-solid food which was given him quite well and without apparent difficulty or delay in swallowing. After a residence of some days pleurisy became obvious and the child died. On post-mortem examination the œsophagus was found perforated by an impacted halfpenny, which had produced inflammation in the mediastinum. Such cases emphasise, what is the fact, that spasm may not be a prominent accompaniment to foreign bodies impacted in the œsophagus. It is also noteworthy that the diminution of the œsophageal calibre was not accompanied by regurgitation or difficulty in swallowing fluid food.

Sir Sinclair Thomson¹⁹ records the successful removal *per oram* of a tooth-plate which had been impacted in the

“Cardiospasm,” Congenital Narrowing, etc.

œsophagus during two and a half years, which rendered the patient unable to swallow solid food. He quotes a case recorded by Guisez of a ten-centimetre piece having lain in the œsophagus for four years. These, however, are nothing to the case referred to by Tilley,²⁰ in which “Brandon Kyle, Philadelphia, removed a denture after seventeen years’ sojourn” in the œsophagus! Finally, in this connection, Kahler²¹ records the case of a man sent to hospital as a case of carcinoma of the œsophagus of four weeks’ duration, in which the œsophagoscope demonstrated the impaction of an artificial denture. In these days of radiographic examination such occurrences become less likely.

It would not be right to dismiss the subject of congenital narrowing of the œsophagus without a word about treatment. Recognition of the condition is *the* essential and is *the* treatment. It must never be forgotten that in all forms we are dealing with a congenital defect, and congenital defects are notoriously difficult and unsatisfactory for operation. The anatomical structures are fully developed as far as the embryonic formative material allows, and no mechanical procedure can add to its amount. As regards children, the passage of a bougie, the brutality of a threat, the mental dread of asphyxiation by an anæsthetic, may each or all suggest to the child to have recourse to subterfuge—the refuge of the physically inferior. The only treatment is appreciation of this congenital deformity and the modification of diet or eating throughout life to suit the circumstances. This appreciation will never be obtained until text-books recognise the entity congenital narrowing of the œsophagus is, its syndrome, and its clinical importance.

(To be continued.)

MESENTERIC LYMPHADENITIS SIMULATING APPENDICITIS.*

By J. W. STRUTHERS, M.B., F.R.C.S. Ed.

LYMPHADENITIS, acute or chronic, suppurative or non-suppurative, associated with infection by pyogenic organisms or by the tubercle bacillus, is often seen and gives rise to characteristic signs and symptoms in the neck, axilla, groin, popliteal space or ante-cubital fossa.

Cold abscesses or acute abscesses often develop in glands in these various regions, and, unless previously incised, progress until they burst on the surface. Transient acute lymphadenitis attended with pain, swelling, and tenderness, but resolving without suppuration, is seen almost daily in association with surface lesions on the hands, feet, and elsewhere. Persistent glandular enlargement, apart from tuberculous disease, is occasionally seen after acute infection, but in the great majority of cases chronic lymphadenitis is due to tuberculosis. The lymph glands in the abdomen related to the intestinal tract, particularly those connected with the lower ileum and first part of the large bowel, present some interesting contrasts to those in other parts of the body. They are closely related to a mucous surface over which highly infective material is constantly passing and which is liberally provided with lymphoid tissue. This surface is often the seat of catarrhal inflammation and not infrequently of affections causing numerous breaches of surface, such as typhoid fever and dysentery. In appendicitis we have a suppurative lesion in which the infective material is retained, in the early stages at least, under great tension, and liable, one would expect, to be associated with glandular infection, and yet acute suppurative lymphadenitis is unknown, as far as my observation goes, in association with any of the conditions named. Some degree of glandular enlargement is occasionally seen in appendicitis, but glandular suppuration does not take place in these cases.

Tuberculosis in the mesenteric glands, on the other hand, is extremely common in children and adolescents, as a routine examination of the mesentery in the course of operative work will show. Points of caseation are often seen in the glands and calcification is common, yet complete softening with abscess

* Communicated to the Medico-Chirurgical Society of Edinburgh, 4th May 1921.

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formation appears to be rare in comparison with the frequency of tuberculous infection. The mesenteric glands then are readily susceptible to invasion by the tubercle bacillus. Are they invaded by pyogenic organisms, and does the invasion give rise to a clinically recognisable reaction? Within recent years a number of cases have come under observation in which patients apparently suffering from appendicitis have turned out on operation to be suffering from lymphadenitis, that is to say, the appendix has been found perfectly healthy, and the only lesion detected has been enlargement of the lymph glands in the mesentery with signs of peritoneal irritation over them. In most of the cases, but not in all, the enlargement has obviously been due mainly, if not altogether, to tuberculosis, but whether the acute symptoms simulating appendicitis have been due to the tuberculosis alone, to tuberculosis with super-added transient infection of another kind, or in some cases to non-tuberculous lymphadenitis alone is difficult and, in the meantime, almost impossible to say.

The following brief summaries illustrate the type of case referred to:—

CASE I.—Miss A. B., aet. 19 years, of poor physique and nervous temperament, was suddenly seized with acute pain in the right lower quadrant of the abdomen. Her temperature rose to 103° F., her pulse rate to 120. Tenderness and muscular resistance were present in the right iliac fossa, and during the first night of her illness she vomited several times. Within twenty-four hours the symptoms began to abate and in four days had almost disappeared. Three weeks later the abdomen was opened. The appendix and pelvic organs were perfectly healthy. In the mesentery, near the ileo-cæcal junction, was found a mass of enlarged glands adherent to each other and showing points of caseation. The peritoneum over it was thickened and injected and a coil of small intestine was glued by recent adhesion to one point on the swelling. The glands were not removed. Recovery, immediate and remote, was uneventful, and the patient had no further trouble from the glandular affection.

CASE II.—C. D., an apparently robust little girl aged 9, was seized during the night with pain in the right side of the abdomen. When seen in the morning her temperature was 100.6° F., her pulse rate 110, and she showed tenderness and muscular resistance in the painful area. The tongue was fairly clean and the general appearance was not that of very serious illness. At the operation a few hours later the appendix was found healthy. Scattered through the mesentery and close up to the ascending colon were a number of enlarged glands,

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some obviously tuberculous. Those in the ileo-cæcal angle were most affected and the peritoneum over them was a little injected and œdematous. After operation the symptoms subsided and recovery was uninterrupted.

CASE III.—E. F., a domestic servant aged 15, was sent into hospital towards the end of a fourth attack of illness characterised by right-sided abdominal pain with vomiting and some fever. The first attack was said to have lasted a week, the succeeding attacks two to three days. By the time she was admitted she showed little sign of illness except a slightly furred tongue and a trace of pain and tenderness in the right side of the abdomen, just above the iliac fossa. Some days later the abdomen was opened and the only lesion found was a group of fleshy, enlarged glands in the ileo-cæcal angle. No sign of tubercle was evident, and microscopic examination of a gland removed showed chronic inflammatory hyperplasia without any direct evidence of tuberculosis. Recovery was uninterrupted.

Occasionally, but in my experience rarely, similar clinical features are met with due to leakage of a tuberculous abscess directly into the peritoneal cavity, as in the following case :—

CASE IV.—A. F. P., aet. 4 years, was admitted to hospital with a diagnosis of appendicitis, and with the history that he had had a similar attack some months before. Although he looked flushed and had a quick pulse he had no fever. There was moderate tenderness and resistance in the right iliac fossa. A blood count showed a polymorph leucocytosis of 22,000, and operation was carried out at once. The appendix was healthy. About a tablespoonful of thick yellow pus with particles of caseous material in it was found lying among coils of small intestine just internal to the ileo-cæcal junction. Numerous tubercular glands were scattered through the mesentery, and the pus was found to have come from an abscess which had evidently just burst into the peritoneal cavity. It was cleared out as thoroughly as possible and the abdomen closed. An uneventful afebrile convalescence followed, and the child was discharged three weeks later apparently well.

As a rough illustration of the relative frequency of the condition, I may state that in the two years 1919, 1920, I met with 22 cases of mesenteric lymphadenitis, while during the same period I dealt with 187 cases of appendicitis. In children and adolescents lymphadenitis is more often confused with appendicitis than any other condition.

While I have had the opportunity of seeing some of the cases during the acute stage, the majority have been sent for

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operation after one or several reputed attacks of appendicitis. Most of the patients have been young children, but cases have been met with at 16, 17, 19 and 23 years of age. Many have come from surroundings where the hygienic conditions have been above reproach, and in all but one case the presence of tuberculosis was unsuspected during the acute attacks. From observation of cases and a study of the clinical histories the features of the condition as contrasted with appendicitis may be summarised as follows. The attacks are relatively mild in character with moderate fever and constitutional disturbance. The general appearance is not that of severe illness, and in particular the tongue is not heavily furred, nor has the breath the peculiar and almost characteristic odour associated with appendicitis. As a rule the acute symptoms tend to subside in a day or two if the case is watched.

During the acute stage the glands are not often or readily felt owing to the muscular resistance present. Under an anæsthetic, however, they may be more easily palpated, and when several are adherent to each other the resulting lump tends to be higher and nearer the middle line than the swelling caused by an inflamed appendix with omentum or intestine adherent to it. After an acute attack the persistence of a lump and its situation may clear up the diagnosis. It must be admitted, however, that a positive diagnosis as between appendicitis and mesenteric lymphadenitis often cannot be made. Appendicitis is a treacherous disease, and in doubtful cases a wait-and-see policy is apt to be followed by disastrous results, especially perhaps in children. One thing may be asserted with confidence, namely, that opening the abdomen in cases of lymphadenitis does not appear to influence the glandular affection unfavourably. The patients do well, and I have not yet seen a case in which apparent extension of the tuberculous disease has followed operation.

As regards treatment of the enlarged glands, it may be said that they are best left alone. In cases of tuberculosis removal of all the infected glands is usually impossible without subjecting the patient to a very serious operation involving possibility of damage to the blood-supply of a large area of the intestine. If a gland is completely softened and apparently on the point of bursting it may be dealt with, otherwise tuberculous mesenteric glands should, I believe, be left alone, in view of the fact that spontaneous recovery is the rule. In

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cases where tubercle is not manifest the same rule holds good. In conclusion I would present the following summary :—

1. An inflammatory reaction occurs in enlarged mesenteric glands and the overlying peritoneum, the enlargement being usually but not always tuberculous, which gives rise to symptoms closely resembling appendicitis.

2. While the cause of the reaction cannot be precisely determined, it may be due to exacerbation of the tuberculous infection with periadenitis, to the invasion of tuberculous glands by other organisms, *i.e.*, to the onset of a mixed infection, or to the occurrence of a transient adenitis similar to that seen in other parts of the body in association with surface infections.

Which explanation is the correct one I have been unable to determine. Microscopic examination of glands removed for the purpose has not cleared the matter up. From the evidence as it has presented itself I am inclined to think that most cases are probably due to a reaction provoked by extension of the tuberculous infection.

In any event the affection is a common one and should always be borne in mind in examining young patients presenting signs suggestive of appendicitis. The fact that its existence does not appear to be generally recognised has induced me to make this brief reference to it.

A FURTHER EXPERIENCE OF THE CONDUCT OF LABOUR UNDER "TWILIGHT SLEEP."

WITH SPECIAL REFERENCE TO ITS USE IN PRIVATE PRACTICE.*

By F. W. N. HAULTAIN, M.D., F.R.C.P.

SOME years ago, along with Dr Swift, I published the highly satisfactory results of our management of labour under Twilight Sleep in the Edinburgh Maternity Hospital. Since that time a large number of papers on this subject have been written, and a considerable amount of diversity of opinion has been expressed both by the medical profession and the lay public as to its merits.

Though as a rule admitting its benefits, the medical profession find the supposed difficulty of its adoption in private practice a serious drawback. With the lay public it has been—and is—a theme of discussion of the bitterest character. Its ardent opponents decry it as a most dangerous procedure, fraught with the most appalling results, such as death of the mother and child, which, if they escape, is only to be followed by insanity in the former, or imbecility at birth or subsequent insanity in the latter. How such exaggerated aspersions have arisen it is impossible to account for, and can only be ascribed to ignorance or the vindictive envy of elderly mothers, who lived too soon to have had the chance of enjoying its benefits.

Having had an increased experience in its employment, I have thought it well to give an unbiassed statement of its use from my personal results.

Since my previous paper, I have employed it in every case where the consent of the patient, *Hospital* or *Private*, was obtained—about 800 in all. The results have been correspondingly satisfactory in both.

On this occasion, however, I shall restrict myself to an account of its employment in private practice, as this forms a common source of objection among the profession.

In my last 150 private cases thus treated, 70 were primiparæ and 80 multiparæ. In the former there was complete amnesia in 80 per cent., and partial in 20 per cent. In multiparæ there was complete amnesia in 50 per cent., partial in 30.

* Communicated to the Edinburgh Obstetrical Society at the meeting held on 9th February 1921.

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per cent., and no effect in 20 per cent., due to insufficient time for the action of the drug to take place, the labour having terminated so rapidly.

The treatment adopted in every case was the same. The injection of morphin $\frac{1}{4}$ gr. and hyoscine $\frac{1}{160}$ gr. given in primiparæ, when labour is fairly established, with pains regular and recurring at ten minutes' interval, and in multiparæ whenever definite labour pains are first felt. The patient is put to bed in a darkened room and her ears stuffed with cotton wool, so that her attention may not be attracted by anything. After three-quarters of an hour a further injection of hyoscine $\frac{1}{160}$ gr. is given, and repeated every hour till the labour is completed. Should she become noisy or restless after the second stage is reached, chloroform is given during the pains, as from the absence of self-control she may be difficult to manage. After the child is born, it should be immediately removed to another room to prevent its crying disturbing the mother during the third stage. She should be allowed to sleep till the effects of the drug have passed off—about six hours. When she awakens she is usually unaware she has ever been in labour, and is surprised to see the baby which she scarcely believes can be hers. The largest number of doses given was 53 to a primipara with a rigid cervix and strong labour pains, whilst the smallest number of doses which induced complete amnesia was 4.

It is practically impossible to gauge the amount of analgesia, as the feelings of the patient cannot be strictly estimated while under the effect of the drug, and the description afterwards is not to be depended upon. I have little doubt that nearly all suffer discomfort during uterine contractions, which frequently make them noisy and restless, but of which they have no memory afterwards. When complaining severely during a pain, the discomfort may be referred to the shoulder or back of head if the patient be asked as to its site, while the amount of suffering, though associated with much noise and restlessness, is immediately after discounted as trivial. In one case the mother after much apparent agony during the birth of the head immediately afterwards apologised, thinking she had spilt something and made a mess. It is essential to remember the absence of mental control, as much shouting and restlessness, though it conveys the impression of great suffering to attending friends, is out of all proportion to actual sensations. In one

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instance a patient though screaming at the top of her voice during each pain told me she was enjoying the screaming immensely and could not help it, no pain being mentioned.

It is probably due to this false impression of suffering that fond mothers are apt to decry the treatment. Indeed it is difficult in these cases for one not conversant with the use of the drug to believe that they will be told afterwards of complete oblivion to any sense of discomfort whatever.

The feeling of well-being shortly after the delivery is over, is perhaps one of the most striking beneficial actions, and tends to endorse the absence of conscious suffering. The action of the drug so ravels the action of the brain that no definite impression can be formed; in most, the main action seems to be amnesia; in a few, however, the opposite obtains, and an exaggeration of symptoms is described. The effect varies in individuals, hence the acute differences of opinion in both medical and lay minds, and the bitter controversy that exists and the impossibility of giving a definite opinion without experience.

Among obstetricians this mode of treatment has been decried in private practice, on account of the impossibility of giving personal supervision. This of course would be necessary if one followed closely the rules of Gauss, who regulates the dosage by the memory test. For practical purposes, such a regulation of dosage is unnecessary. Following the simple rule of letting the patient have an injection of $\frac{1}{4 \times 5}$ gr. every hour, though perhaps not so scientifically perfect, is sufficient to acquire the benefits required without danger. This can be done by an intelligent nurse who is in telephonic touch with the doctor.

By this means the medical attendant is saved much needless attendance, as the patient has no desire that he be sent for, indeed when he does arrive he is often not recognised. It may therefore truly be said that if "Twilight Sleep" for the patient, it is often "midnight sleep" for the doctor.

The employment of Twilight Sleep in private practice is ideal as regards surroundings of quietness to the patient and comfort to the medical attendant. So far as my experience shows, there is no risk to mother or child if the nurse carries out instructions by rigid adherence to Gauss's method.

The only disadvantage is the presence of friends and relatives, who, from the symptoms of apparent suffering, are apt

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to enter the room and interfere with the nurse's duties by condoling with the patient or demanding that the doctor be sent for. They cannot be too rigidly excluded. Probably for this reason a number of Twilight Homes have been opened, and the subject thus exploited commercially. These, I feel, have materially influenced the medical profession against the advantages of the treatment, and they should be avoided as not essential.

So far as my experience goes and my statistics show, there is no risk either to mother or child. The latter in 3 per cent. was born oligopnoeic, or, in other words, with a blue colour and very shallow breathing. In each of these cases it recovered spontaneously without treatment of any kind. In four cases the child was born asphyxiated, three of these were after hard forceps traction, and one in a breech presentation with slight delay in the birth of the after-coming head. One child was born dead after craniotomy, having had twenty-three doses to favour head moulding. The patient has had two subsequent healthy children under Twilight Sleep, labour having been induced at the end of the eighth month. No complications were noted that could possibly be attributed to the treatment.

In six cases labour was induced; in none of these did the child appear affected by the drug. Forceps were applied thirty-nine times in the 70 primiparæ and twice in the 80 multiparæ. This I do not consider as more frequent since the use of scopolamine, as I have always followed a rule of using forceps if the head is in the pelvis and the second stage has lasted more than three hours in a primipara and two hours in a multipara.

When the head fails to come through the brim in minor degrees of pelvic contraction, I prefer to wait much longer, to permit of head moulding, and in these cases I believe scopolamine is of the greatest advantage in diminishing the suffering during the long second stage. In a similar way, breech cases are assisted by allowing labour to painlessly proceed during the possibly long period of complete dilatation of the passages by the breech, and thus permit of rapid delivery of the head.

I have twice observed patients become so unruly as to be maniacal, trying to bite and refusing to lie in bed. In these cases chloroform was administered deeply, which quickly controlled the symptoms. Complete amnesia was present in both cases.

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To summarise the results, I should like to impress the extreme benefits of the so-called Twilight Sleep under the following headings:—

1. It is apparently harmless to mother and child and can be used in the manner described without fear.
2. It does not interfere with the normal course of labour and is not the cause of any complication from inertia, such as post partum hæmorrhage or retained placenta. It may, however, slightly delay the second stage by demolishing voluntary assistance in bearing down.
3. It is of particular value in breech cases, or minor degrees of pelvic contraction, where it is desirable that the second stage of labour be prolonged to attain satisfactory results.
4. It saves the constant attendance of the medical attendant which is demanded by nervous patients, and is so irksome.
5. The feeling of well-being even after a long and difficult labour is one of its most striking and satisfactory benefits.
6. It prevents mothers having the fear of subsequent labours, and thus must tend to increase the birth rate as regards their own families, and also stimulate their friends to do likewise.

Generally speaking, I cannot help admitting to being a fervid supporter of the method, and each succeeding case increases my faith in and enthusiasm for its employment. I consider it the greatest advance in obstetrics since the employment of chloroform, and that it vies with this in its effect of abolishing the terrors of the pains of labour.

I have brought the subject before the Society not with the idea of introducing anything new or fresh, but solely with the intention of eliciting an expression of opinion which must, from the well-known eminence and experience of its Fellows, guide the profession and lay public in forming an idea of the true value of this means of helping our women in the sore straits of performing their normal function.

It is a subject the importance of which cannot be overestimated. In other words, the discussion should decide whether it is to be adopted as a safe and distinct gain to suffering women, or to be rejected as risky and dangerous and unworthy of trust for the benefits gained.

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Given in the method described, it is in my experience absolutely harmless and satisfactory. I have adopted therefore no variations beyond giving a further $\frac{1}{8}$ gr. of morphin where much restlessness is experienced before full dilatation of the cervix.

Thus the patient who had fifty-three doses and four additional doses of morphin $\frac{1}{8}$ gr., at intervals of from eight to ten hours. Though restless and noisy, no knowledge of her labour was remembered, and the child was born healthy and lively.

Morphia has been credited with being the cause of the oligopnœa. This I am not prepared to admit, as very much larger doses are given in eclampsia without such evil effects. It would appear, therefore, as if it was an idiosyncrasy on the part of the child in a very small percentage of cases.

The opponents of the Twilight Sleep method are only too ready to clutch at any straw to deprecate it, and well-marked cases of asphyxia pallida are debited to its use. These I have never seen without a reasonable cause from obstetric difficulty and delay.

It is almost inconceivable the depths to which lay opponents of the method will descend, and, curiously, these are more readily absorbed by the community than the marked successes of its supporters.

There is little doubt that the foundation of this antipathy to the use of Twilight Sleep is due to the medical profession, some of whose members who from fear, *laissez faire*, or ignorance, discredit it or at least damn it with faint praise, without having given it a thorough fair trial.

So far, I know of no authentic statistics published of the number of fatalities, lunatics or imbeciles, due to its use; still, cases are quoted by the general public as occurring frequently, and though I have tried hard I have been unable to find a reliable case.

It would appear to have resuscitated the bitter controversies of the introduction of chloroform, and it seems to me strange that women are so reluctant to be deprived of the pangs of labour. But, like chloroform, I feel that when more thoroughly understood, it will be more universally adopted and acknowledged to be a great triumph of medicine, giving, without harm or risk, relief to the most severe type of natural suffering.

Thanks to the lay journals, the subject has been given so

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much publicity that at present every well-to-do woman who is about to become a mother for the first time, has it thoroughly debated.

As has been already stated, the hearsay evidence of her friends is most conflicting, and generally derogatory. It thus is essential that the medical attendant shall be able to give an opinion, based on personal experience, or on that of others who have had the opportunity of acquiring it.

It is with this object I have brought my experience before you, in the hope that we may elicit that of some of the other Fellows who have been equally favourably placed, to gain a knowledge of its worth.

By this means the expecting mother will have the satisfaction of having a true estimate of whether there is any risk to her child or self, in trying to abolish the agonies of its delivery in this manner.

The success of the treatment lies in the strict observance of the method described, and I feel certain that many of the failures must be accredited to variations in the amount or frequency of the dosage. Given in the manner described, my experience is such that I must strongly urge its adoption on all occasions, as its effects are so eminently safe and satisfactory.

CRITICAL REVIEW

NOTES ON THE WASSERMANN REACTION.*

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Foreword.

THE following account of the evolution and present position of the Wassermann reaction is designed to make as plain as possible to practitioners of medicine the principles upon which this test is based. The subject is not dealt with in a controversial spirit and nothing new is contributed to our knowledge of the test, but an attempt is made to review the development of the reaction without employing unnecessary technical terms. By so doing, it is hoped that the difficulties experienced by the laboratory worker may be explained to, and appreciated by, the clinician.

There is no room for misunderstanding in the work of control of venereal disease, and the difficulties concerning the Wassermann test would to a large extent disappear, if he who is responsible for one branch of the work was made conversant with the difficulties met with by his colleagues responsible for the other.

In medicine, many subjects are seen in correct perspective only if viewed from the evolutionary standpoint, and this is especially true of the test under discussion. For this reason the various phases in the development of the Wassermann reaction are herein discussed in logical rather than in chronological sequence, and I would call attention to the fact that this review therefore makes no claim to historical accuracy.

While much remains to be done in elucidating the actual mechanism of the test, it cannot be gainsaid that the "Wassermann," if it be carried out carefully and the various sources of error duly appraised, gives valuable information concerning syphilis, but it cannot be too strongly impressed upon us that in this reaction we have only an empirical test for the diagnosis of that disease, and, in fact, it is a coincidence that the reaction ever came to be elaborated, and a very remarkable coincidence indeed that the information which it gives is accurate.

I have of set purpose refrained from quoting from the extensive literature, but although no bibliography is appended, I am not unmindful of the deep debt of gratitude which we all owe to those

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investigators who, with tireless energy and consummate skill, have added to our knowledge of the test, and it is with a feeling of pleasure that one notes how much of the most illuminating work in this connection has been carried out by our fellow-countrymen.

Evolution of the Complement Deviation Method.

The phenomenon upon which are based the so-called "Complement Deviation" tests—of which the Wassermann reaction is one—is known as (biological) lysis, and of this the historic example is bacteriolysis.

To take a specific case.—If one immunises an animal by inoculating it with graduated doses of cholera vibrios, and, when immune, injects into the peritoneal cavity of the animal a culture of that organism, it is found that the peritoneal exudate of such an immune animal is able to digest or "lyse" the micro-organisms in the exudate. This digestion of bacteria injected into the peritoneum of an immune animal proceeds rapidly, and a specimen of exudate, taken twenty minutes after the material has been administered, will show the micro-organism globular in shape or otherwise distorted and staining feebly and irregularly; after a lapse of an hour or two all the bacteria will have completely disappeared. If some of the same culture be injected into the peritoneum of a normal animal of the same species, the bacteria are not digested.

A new property has therefore been conferred on the body fluids of the animal by the process of immunisation, and this new property is specific in respect of the micro-organism against which the animal has been immunised. The peritoneal exudate called forth by inoculating cholera vibrios into the peritoneum of an animal, which has been immunised against that organism, exhibits this digestive action only on vibrio cholerae. The exudate called forth by injecting typhoid bacilli into the peritoneum of that same animal would fail to digest these.

This specificity is a feature of all immune sera—they only act on homologous micro-organisms (or homologous foreign proteins)—and upon this specificity depends their application to the differentiation of micro-organismal species and to the diagnosis of disease.

It was next found that the blood serum of immune animals when freshly drawn, acted *in vitro* in a manner akin to the peritoneal exudate of the living animal, but the digestive or "lytic" activity of such sera was found to be evanescent, so that on being stored the lytic property rapidly deteriorated; further, if the fresh serum were heated to 56° C. for thirty minutes its activity was entirely destroyed.

Such immune sera when they have deteriorated by storage, or as a result of being heated to 56° C., are spoken of as "inactivated."

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The specific quality conferred upon those sera by immunisation of the animal from which they were derived, is not lost, however, through lapse of time or by heating to 56° C., as was shown by what is known as Pfeiffer's phenomenon, and, as this phenomenon really constitutes the starting-point of all the investigations which ultimately led up to the Wassermann test, it is worthy of full discussion.

If some immune serum, which has been inactivated by prolonged storage or exposure to heat, be mixed with a culture of the homologous micro-organism, lysis does not take place, but if the mixture of homologues be injected into the peritoneum of a *normal* animal, digestion of the bacteria takes place just as though the test were made by injecting bacteria alone into the peritoneum of an *immune* animal.

It should here be noted that it is of but little import whether the immune serum has been derived from the same, or other, animal species, as that into which the "serum-organism mixture" is injected intraperitoneally for the actual test, *e.g.*, "anti-cholera serum derived from a rabbit plus cholera vibrios" injected into the peritoneum of a guinea-pig will result in an exudate that dissolves the vibrios injected. In such circumstances the specificity of the test is in no way interfered with, and it is only when mixtures of homologues are used that lysis occurs.

Substantially the same effect is obtained when fresh normal serum, from any animal species, is added *in vitro* to a mixture of, for example, anti-cholera serum and cholera vibrios, and the whole incubated at 37° C. In the *in vitro* experiments, however, it is not always so easy to demonstrate the "solution" or "digestion" of the bacteria as is the case when the *in vivo*—intraperitoneal—technique is employed.

The advantage of Pfeiffer's test was that it could be carried out rapidly, for normal guinea-pigs constitute one of the ordinary reagents of all bacteriological laboratories, while immune sera, in the inactivated state, can be kept in a cool place for months and even years without undergoing marked deterioration. Such sera can be reactivated by addition of fresh normal serum.

Theoretically, this test may be universally applied to the differentiation of bacteria and other formed solid elements of protein constitution, but technical difficulties rather limit its utility.

If we analyse Pfeiffer's reaction, it is seen that in the process of bacteriolysis there are three factors which are necessary:—

- (a) The material to be dissolved—bacteria;
- (b) The factor resident in immune sera. This is specific in relation to "*a*" and is stable;

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- (c) The factor resident in *fresh normal serum*. This, for want of a better term, may be described as a "ferment-like quality."

Bacteriolysis only occurs in presence of "c" and then only if "a" and "b" are homologous. Factor "c" is a quality of freshly shed normal blood derived from any animal species.

Special nomenclature is used in describing these reagents, and, unfortunately, some note will have to be made thereof.

("a") is called an antigen—a substance which, when inoculated into an animal, calls forth a specific response made manifest by an alteration in the qualities of the serum of that animal.

("b") is the altered condition of the serum of an animal inoculated with "a," and the expression of this alteration is referred to in general terms as evidence that the serum contains antibody.

("c") the ferment-like quality of all freshly shed blood is usually called complement. It is complement which dissolves "a" in presence of "b," but has no, or little, influence on "a" in absence of "b," or in "b" in absence of "a."

When antigen is mixed with its homologous antibody (e.g., typhoid bacilli with anti-typhoid serum, or with the serum of a patient convalescent from typhoid), a new substance is formed consisting of both antigen and antibody, this is referred to as an "antibody-antigen complex." It is such complexes that complement acts upon, and in acting upon them its ferment-like quality is used up or "deviated."

We could, therefore, employ the Pfeiffer phenomenon for determining the presence of an unknown antigen by mixing this with known antibodies and exposing the mixtures to the dissolving activity of fresh serum, solution would occur only when the antigen and antibody were homologous and, knowing the latter, we could draw a conclusion concerning the presence, or absence, of the former. The converse experiment of determining the presence of an unknown antibody in a serum can also be carried out. If we mix the serum under examination with known antigens in presence of complement, solution of the particles of antigen occurs only in mixtures of homologues, and so the test could be used to diagnose disease of an infective nature, provided of course the disease had been sufficiently prolonged to permit of the elaboration of antibodies.

It is obvious that the application of this test is limited to those instances in which the antigen is a "solid," i.e., composed of formed elements, for the demonstration of a positive reaction depends on the solution of particles of the antigen.

It is to be noted that all true antigens have the character of proteins, but some proteins are fluid, and in such circumstances

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the test is inapplicable. Attention is specially called to the fact that all *true* antigens are proteins, for it is this fact which places the Wassermann in a category by itself.

I have drawn attention to the limited application of Pfeiffer's phenomenon—direct bacteriolysis—in practical serology in order to lay stress upon the almost universal application of the indirect method of conducting the same test.

The genius of Bordet and of his collaborator Gengou made possible the almost universal application of the principles of Pfeiffer's phenomenon for the differentiation of micro-organismal species on the one hand, and for the diagnosis of infective maladies (of known ætiology) on the other.

The great contribution which these investigators made was the elaboration of an indirect technique for demonstrating bacteriolysis. The indirect technique is much more delicate than is the direct method. Bordet's reasoning was as follows—If a mixture of, for example, typhoid bacilli and anti-typhoid serum be exposed to fresh normal serum, two things will happen:

- (a) The immune serum and the bacilli will unite to form a "complex."
- (b) That "complex" will attract the ferment-like quality of normal serum and will render it inert.

Now, if a reagent can be prepared which will show with delicacy whether complement remains active after exposure to a mixture of antigen and antibody which are *heterologous*, and is deprived of its activity after similar exposure to a *homologous complex*, it will be possible to elaborate an indirect method for conducting the test.

In the Bordet-Gengou reaction, red blood cells, which have been "sensitised" by addition of the appropriate anti-serum, constitute the "indicator" that serves to show whether complement does, or does not, remain active after exposure to a presumed complex.

Washed sheep corpuscles, to which has been added anti-sheep-corpuscle serum—prepared by immunising an animal with washed sheep red cells—are usually employed as the indicator in the test, and the reaction is carried out in two stages. It need scarcely be pointed out that the term "sensitised sheep cells" is synonymous with "sheep corpuscle anti-sheep-corpuscle serum complex."

The value of the "corpuscle anti-corpuscle serum complex" as an indicator of activity of complement is that the sensitised red cells are very susceptible to solution by complement, so that the delicacy of the reaction is assured. Further, the solution of red cells is self-evident owing to the laking of the blood.

The central fact of the phenomenon is that "homologous complexes" have the property of attracting complement, and thereby render

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it inert. If, then, we expose complement to such a "complex" during phase 1 of the test, and subsequently—phase 2—add sensitised cells to the mixture, the cells remain unaffected; but, if during phase 1 a "complex" has not been present, the complement remains active, and, on the addition of sensitised cells, lysis of these takes place so that the fluid, on further incubation, assumes the character of laked blood.

To take specific examples—In two tubes "a" and "b" the following reagents are mixed:

<i>Tube "a."</i>	<i>Tube "b."</i>
(i.) Antigen, emulsion of <i>B. typhosus</i> .	Emulsion of <i>B. coli</i> .
(ii.) Antibody, anti-typhoid serum.	Anti-typhoid serum.
(iii.) Complement, fresh normal guinea-pig serum.	Fresh normal guinea-pig serum.

Both tubes are then incubated at 37° C. from one to two hours.

In tube "a," (i.) and (ii.) form a homologous complex, while in tube "b" they do not; in "a" the complement will be rendered inert, while in "b" it will remain active.

If, now, we add to both "a" and "b" some suspension of sensitised cells, and further incubate at 37° C., those cells added to "a" will remain unaffected, while those added to "b" will be laked, *i.e.*, "a" shows a positive complement "deviation" and "b" a negative.

In the reaction thus indirectly performed the antigen may be any "foreign" protein in any form—a suspension of foreign cells (*i.e.*, derived from some animal of a species other than that into which they are inoculated), a suspension of bacteria, foreign serum, etc. Provided it is protein in character, and will, therefore, on inoculation into animals, call forth a specific response, almost anything will act as an antigen in a test of this kind, for, when exposed to its appropriate antibody, it forms a "complex" and so deviates complement.

The test is therefore of very wide application in immunological work and may be used to determine the presence of a given antigen, in which case the test is made by using an appropriate known antibody, or, conversely, for determining the presence of given antibodies in serum, when, of course, the appropriate antigens are employed.

To illustrate its applications the following examples may be taken:—

I. To determine the presence of a protein in material in which that protein should not normally be found.

It is suspected that a given brand of sausages is adulterated by addition of horse-flesh.—How are we to determine whether this is or is not so?

(i.) Antigen for the test is obtained by making a saline extract

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of the sausage. If horse protein is present it will be one of the constituents of the extract.

(ii.) Antibody to horse protein. This is prepared by immunising a rabbit with extract of horse-flesh—horse serum will subserve this purpose. This antibody is, of course, prepared beforehand and would be one of the standard reagents of a laboratory where examination of food is a routine procedure.

Then—

- (a) Antigen—extract of suspected sausage ;
 - (b) Antibody—anti-horse-protein serum ;
 - (c) Complement—fresh normal guinea-pig serum,
- are mixed and incubated.

If “a” contains extract of horse-flesh, “a” and “b” will form a “complex” which renders “c” inert, so that on adding sensitised cells these are not dissolved on further incubation.

If “a” contains no extract of horse-flesh, a complex is not formed in phase 1, and on adding the sensitised red cells these are dissolved. Using the appropriate anti-serum, the presence of any protein in any form can be demonstrated in this way.

II. The test is most frequently employed for the differentiation of micro-organismal species, and the following example will serve to illustrate this application.

A micro-organism, morphologically and culturally resembling vibrio cholerae, is obtained from the faeces of a person suffering from diarrhoea.—Is that micro-organism vibrio cholerae or is it not?

The following experiment would give the information required.

Mix together :

- (a) Antigen—a suspension of the suspected organism ;
- (b) Antibody—known anti-cholera serum ;
- (c) Complement—fresh normal guinea-pig serum.

Incubate at 37° C. and, if “a” be vibrio cholerae, “a” and “b” will form a complex which renders “c” inert, so that on now adding sensitised cells, and further incubating, these remain unaffected. If “a” is not vibrio cholerae no complex is formed in phase 1, so that on adding the sensitised cells, complement remaining active, these are lysed.

III. To determine the presence of specific antibodies in the serum of an individual suffering from a suspected infective condition and so assist in arriving at a diagnosis.

A case of what appears to be hepatic neoplasm is presented for examination and the question of hydatid disease is raised. If it can be shown that the serum of the patient contains antibodies to

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the proteins of *Tenia echinococcus*, there is strong presumptive evidence that the case is one of hydatid disease.

The following experiment can be carried out—

Mix together :

- (a) Antigen—the contents of a hydatid (obtained usually from veterinary sources);
- (b) ? Antibody—serum of the patient under examination;
- (c) Complement—fresh normal guinea-pig serum.

Incubate the mixture; subsequently add sensitised cells, and continue incubation.

If “b” contain antibodies specific to “a,” a complex is formed in phase 1, and the sensitised red cells added in phase 2 remain unaffected, indicating that the patient is infected with *T. echinococcus*. If “b” contain no antibodies to “a” a complex is not formed in phase 1, and the cells added in phase 2 are dissolved, showing that the patient has no antibodies to *T. echinococcus*, and is therefore presumably not infected with that worm.

A positive result is naturally of much more significance than a negative in cases of the type described in Example III., for, in order that a positive reaction may occur, it is essential that the infection be sufficiently severe to call forth a response, that it be of sufficient duration to permit of the elaboration of antibodies, and, further, that the patient be in a fit state to react.

The concept upon which the Wassermann reaction is founded is that exemplified in No. III., while the actual technique of the test is but a modification of that employed in the Bordet-Gengou phenomenon.

Evolution of the Wassermann Test from the Bordet-Gengou Reaction.

On the publication of Bordet's work, Neisser, Wassermann and Brück suggested that the Bordet-Gengou technique might be adapted to the diagnosis of syphilis by a serological test.

These authors reasoned thus:—“The natural inoculation—infection—with *T. pallidum* should call forth the production of specific antibody on the part of the infected man, and such antibody should be demonstrable in the serum of syphilitics. If, then, the necessary antigen can be prepared, the Bordet-Gengou phenomenon may be applied to the diagnosis of syphilis.”

The difficulty met with was that *T. pallidum* had not then been cultivated, although its presence in enormous numbers had been demonstrated in the internal organs of still-born syphilitic fetuses. Neisser, Wassermann and Brück therefore extracted with saline such

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heavily infected organs—liver was usually employed—and used these saline extracts as antigens in the complement deviation test for syphilis.

Mixtures of the following type were set up:—

- (a) Antigen—saline extract of syphilitic liver rich in *T. pallidum*;
- (b) Antibody—serum of patient suffering from syphilis (inactivated before use);
- (c) Complement—fresh normal guinea-pig serum.

Incubate at 37° C., thereafter add sensitised cells and continue incubation as in the Bordet-Gengou reaction. If “a” and “b” form a complex, complement is rendered inert.

Applying this test to sera from a large series of cases of syphilis, and to a similar series of sera in which syphilis could be excluded, these investigators obtained very encouraging results if quantitative methods were employed.

It seemed, therefore, that the Wassermann test was a straightforward application of the Bordet-Gengou reaction to the diagnosis of syphilis, and that a true antigen was obtained by extracting syphilitic liver with saline.

The antigens made by saline extraction were, however, not wholly satisfactory, being difficult to preserve, and were, moreover, somewhat uncertain in quality, and their value in the test did not run *pari passu* with the degree of infection noted in the organs from which they were prepared.

Therefrom arose the most important factor in the subsequent evolution of the reaction, viz., by extracting syphilitic liver with *alcohol instead of saline* an extract was obtained which, on being diluted in saline, acted as “antigen” in the test.

These alcoholic extracts were found to be stable, they reacted as well as the saline extracts, and, in presence of syphilitic serum, were more uniform than those in their “deviating” qualities.

Tested over large series of cases these alcoholic extracts, when used as “antigens,” gave substantially correct results in tests controlled by careful clinical observation.

Proteins are, however, insoluble in alcohol, therefore the alcoholic extract was probably not a true antigen but was merely a substance, or mixture of substances, which, in presence of syphilitic serum, behaved like a syphilitic antigen.

Examination of these extracts showed that they consisted of mixtures of lipoids—lecithin and cholestearin—and these lipoids were present in extracts of syphilitic liver in quantities which were very similar to what could be extracted from *normal* liver.

If that were so, an alcoholic extract of normal liver might subserve the function of the so-called antigen in the Wassermann test. This was essayed, and quite satisfactory results were obtained.

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It is plain, then, that organ extracts deviate complement in presence of syphilitic serum not because such extracts contain syphilitic antigens, but because syphilitic serum, in presence of suspensions of certain lipoids, forms "pseudo-complexes," which, like true antibody antigen complexes, have the property of rendering complement inert. The term antigen should therefore always be written "*antigen*" in describing the Wassermann test.

Going a step further, one ought to be able to prepare satisfactory "antigens" by dissolving purified lipoids in alcohol and diluting these in saline for actual use in the reaction. This was now tried and many "antigens" so prepared were found to react satisfactorily.

This led to a series of extensive investigations which had for their object the elaboration of optimum methods for preparing the extracts, and for determining the relative and absolute concentration in which the lipoids of these should be employed as "antigens." This work greatly assisted in arriving at really sound methods of conducting the test.

The fact that the Wassermann test ever gave results of any value was therefore remarkable, for, though the technique employed is that of the Bordet-Gengou reaction, the principles upon which each depends are very different.

No one, *a priori*, would have expected syphilitic sera to possess this peculiar property of deviating complement in presence of lipoids and it is, indeed, only a coincidence that they do possess it, while it is a remarkably fortuitous circumstance that this property is almost constantly exhibited by the serum in syphilis, and practically only in syphilis.

The fundamental difference between the Bordet-Gengou phenomenon and the Wassermann reaction is that:—

(i.) In the former, complement is deviated by true complexes, composed of true antigens and true homologous antibodies.

(ii.) In the latter, complement is deviated by a "pseudo-complex" composed of "pseudo-antigen" (lipoid) and some peculiar constituent, or property of serum, which property is developed, or enhanced, as a result of infection with *T. pallidum*.

This serves to emphasise the essentially empirical nature of the Wassermann, and I would here draw special attention to the fact that the only information upon which the efficiency of the test can be assessed, is obtained by sound clinical observation. By clinical observation I mean not only the examination of individual cases of obvious syphilis or parasyphilis, or cases with an obvious syphilitic history, but the wider investigation of personal and family history, enquiring into all previous illnesses and, most important of all, a critical study of the results of anti-syphilitic treatment in obscure

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cases of illnesses in which the syphilitic factor is not manifest but the serum reaction is positive.

Nature of the Change which occurs in the Serum of Cases of Syphilis.

There is no evidence, so far, that the peculiar property of syphilitic serum alluded to, is an expression of its containing true antibodies to *T. pallidum*, and we have frankly to admit ignorance concerning the origin and nature of this property.

Thus (i.) some regard the Wassermann reacting quality of syphilitic serum as an expression of its containing true antibody—on insufficient grounds, I think; (ii.) others regard it merely as a normal quality of all human sera which is unduly enhanced in syphilitic infections; (iii.) a third view which is at present worthy of consideration—a view which is here expressed with reservation, but which, I think, may ultimately prove correct—is that the Wassermann quality of syphilitic serum depends on its containing what are known as heterogenetic antibodies.

These heterogenetic antibodies will be discussed later, as they are of paramount importance in actually conducting the test, even if they do not serve wholly to explain its mechanism.

We are ignorant, too, of the source of, or stimulus for, the production of the Wassermann reacting substance of syphilitic serum, and here again diverse opinions have been offered.

(a) Some regard the substance of *T. pallidum* as the direct and specific stimulus which leads to the production of the Wassermann reacting quality of syphilitic serum.

(b) It might be suggested that the quality is developed as a result of reaction set up by the absorption of the granuloma, so that the breaking-down cells of the inflammatory tissue would constitute the antigen for the production of the "Wassermann antibody." This view, while perhaps not absolutely untenable, is somewhat fanciful, for "auto-antibodies"—i.e., antibodies to the tissues of the actual animal furnishing the antibodies—have never really been satisfactorily demonstrated.

(c) It is possible that the stimulus calling forth the production of the Wassermann reacting quality is *T. pallidum*, but that *T. pallidum* brings this about only indirectly.

The suggestion here offered is that infection with the micro-organism of syphilis stimulates, in man, the production of—

- (i.) True antibodies to the proteins of *T. pallidum*. These have not, so far, been made the subject of investigation, at least on a large scale.

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- (ii.) Heterogenetic antibodies which are able to fix or deviate complement in presence of suspensions of certain lipoids. It is the presence of the latter in the sera of syphilitics which we probably demonstrate in the Wassermann test.

The Importance of Heterogenetic Antibodies in the Wassermann Test.

It is not easy to explain in non-technical language what is meant in immunology by the term heterogenetic antibodies, but a short note of explanation should clear up this difficulty and make plain their significance in the test under review.

If *B. typhosus* be inoculated into an animal, the only effect—from the immunological point of view—upon the animal, is to cause the elaboration of antibodies specific to *B. typhosus*, if *V. cholerae* be injected, antibodies specific to that organism are produced.

The specificity of this phenomenon is so marked, that it came to be assumed that the relation between inoculated antigen and resulting antibody was one of almost mechanical precision.

The relation is by no means accurate, however, for, if suspensions of cells derived from the organs of certain animal species be injected parenterally into animals of certain other species, two kinds of antibodies are elaborated—

- (a) One specific to the protein of the injected cells, and
- (b) Another which reacts with cells, and moreover with the lipoids of cells, of other, and often of many other, species.

For example, if ground-up guinea-pig kidney be injected into a rabbit there are produced—

- (a) True antibodies which react with guinea-pig tissues to produce true complexes.
- (b) Heterogenetic antibody which reacts with, for example, sheep's red cells to produce a pseudo-complex.

If the inactivated serum of a rabbit immunised against guinea-pig kidney be mixed with sheep red cells, in presence of complement, lysis of the red cells takes place just as though these had been sensitised by anti-sheep-corpuscle serum.

Why on injecting guinea-pig kidney into a rabbit such an antibody to sheep's red cells should be elaborated, is at present quite inexplicable.

Not only will such a reaction occur with whole sheep cells in presence of (rabbit) "anti-guinea-pig-kidney serum," but an analogous effect is brought about by mixing that serum with the lipoids which

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can be extracted by alcohol from sheep red cells. If the following reagents be mixed—

- (a) Serum of rabbit immunised against guinea-pig kidney ;
- (b) Saline suspension of lipoids extracted from sheep red cells ;
- (c) Complement,

and incubated at 37° C. it is found that complement is rendered inert, just as though “a” and “b” had formed a true complex.

Furthermore, the serum of such a rabbit will render complement inert not only when mixed with suspensions of lipoids from sheep red cells, but will exert a similar inhibition of complementary activity when mixed with the lipoids extracted from any material possessing requisite heterogenetic qualities. Thus the lipoids of guinea-pig heart, guinea-pig kidney, of horse serum, of cat kidney, and of organs from a considerable variety of animal species, are endowed with such heterogenetic qualities and will deviate complement in presence of the serum of a rabbit immunised against guinea-pig kidney.

A point of extreme importance is the species of animal used for preparing these heterogenetic antibodies, for one species may respond in one way and another in another to immunisation with the same antigen. Injection of cat organs into a *rabbit* will result in the production of antibodies specific to cat protein, and may also lead to the elaboration of heterogenetic antibodies for sheep corpuscles, etc., but injection of cat organs into a *guinea-pig*, while it will certainly lead to the production of the former, need not necessarily give rise to the latter.

It is to be specially noted that human organs, and ox organs, do not possess heterogenetic antigens in respect of the heterogenetic antibodies to the lipoids of sheep cells, guinea-pig heart, etc., for this has an important bearing on the preparation of the “Wassermann antigen.”

The importance of these heterogenetic antigens and antibodies is by no means fully appreciated, and but few of them have so far been adequately investigated.

It is especially important to note that some normal sera may contain these. Thus certain normal human sera are found to sensitise sheep red cells to the dissolving action of complement. This might be due, either to such sera containing a true natural antibody to sheep cells, or a heterogenetic antibody to these. That the latter is probably the case, is shown by the fact that such human sera when mixed with lipoids extracted from guinea-pig or cat, organs which act as heterogenetic antigens in respect of sheep red cells, produce pseudo-complexes that render complement inert.

Sera of this nature would give a false positive Wassermann were the antigen employed in the test made by extracting guinea-pig heart

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with alcohol, guinea-pig heart extract has been used as the source of Wassermann "antigen" lipoids, but in view of our knowledge of heterogenetic antibodies, its employment is now indefensible.

When we consider the Wassermann test, bearing in mind what has just been noted concerning heterogenetic antibodies, the potential sources of error appear to be so great that it is marvellous how precise the results of the test have proved to be.

In the test we mix—

- (a) "Antigen,"—a suspension of lipoids extracted from animal organs ;
- (b) Inactivated human serum ;
- (c) Fresh normal guinea-pig serum,

which are incubated for some time, phase 1, and thereafter sheep cells, sensitised with anti-sheep-corpuscle serum *derived from a rabbit*, are added as the indicator for determining the activity of complement, phase 2.

Now, in phase 1, the human serum may have heterogenetic antibodies which — apart from syphilis — form pseudo-complexes with "antigen." An example of this has already been quoted, viz., the use of guinea-pig lipoids as the "antigen" in testing human serum which has natural heterogenetic antibodies for sheep red cells.

Moreover, the "antigen" lipoids, unless properly chosen, may have heterogenetic qualities which react with some constituent of the guinea-pig serum, and in such circumstances the vehicle of the complement would itself take part in the formation of a pseudo-complex that deviates complement.

The source of the lipid used for preparing the "antigen" is therefore of paramount importance if correct results are to be obtained, and it has been found that extracts of either human heart, or ox heart, or liver, are most satisfactory in that syphilitic sera react specifically with them.

But even with an "antigen" prepared from these lipoids our difficulties are not completely overcome, for the serum of certain guinea-pigs does contain bodies which form "pseudo-complexes" in presence of lipoids of human origin. Were the serum of such a guinea-pig employed in the test, false positives would result owing to the guinea-pig serum forming a pseudo-complex with the "antigen," which pseudo-complex would render the complement inert.

It is worthy of note that the natural anti-human heterogenetic antibody of fresh normal guinea-pig serum is especially active in respect of human corpuscles, or the lipoids which may be extracted from human corpuscles, of hæmic Groups I. and II., and it would therefore be advisable to determine if possible the blood group of the

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individual from whose tissue "antigen" is to be prepared. This can be easily done at post-mortem examination.

It is conceivable, too, that human serum may occasionally contain sufficient lipid to form, with the natural anti-human heterogenetic antibody of guinea-pig serum, sufficient pseudo-complex markedly to affect the activity of complement.

The difficulties arising from the presence of heterogenetic antibodies in the vehicle of the complement—fresh normal guinea-pig serum—are met by special preliminary investigations of complement before it is used in conducting actual tests.

It is phase 1 of the test that really presents the major difficulties which have their origin in the presence of heterogenetic antibodies, and antigens, natural to each reagent used in this stage of the test, such reagents should therefore be so arranged that no complex, or pseudo-complex, is formed other than that of "syphilitic" serum plus "antigen."

The reagents of phase 2 of the reaction are not quite so important from this point of view, for, provided that the "corpuscle anti-corpuscle serum complex" used in this phase be sufficiently susceptible to the lytic action of complement, it will be a suitable indicator for determining whether, in phase 1, the complement has or has not been rendered inert.

Even in this phase, however, the presence of these disturbing factors cannot be ignored, for the vehicle of the anti-sheep-corpuscle quality used for sensitising the cells, is rabbit serum, and this may contain heterogenetic antibodies whose influence upon the test cannot readily be assessed.

Theoretically, the ideal Wassermann would be conducted thus: If we were testing the serum of a person known to belong to hæmic Group IV, we should use for phase 1—

- (a) "Antigen"—lipoids extracted from a Group IV. heart;
- (b) ? Antibody—inactivated serum (Group IV.);
- (c) Complement—Fresh normal human serum from an individual belonging to Group IV.

and for phase 2, Group IV. human cells sensitised with the serum of rabbit immunised with Group IV., human corpuscles.

In such a test the only "foreign" material would be the "anti-human cell (rabbit) serum," and this should be so prepared that it is of high titre, *i.e.*, it should act in low concentrations, so that as little rabbit serum as possible may be present in the mixture.

Of course technical difficulties preclude the use of such a method in making routine tests, but I propose to do a duplicate series using this and the ordinary laboratory method which I at present employ, so that the results obtained by the two may be compared.

Notes on the Wassermann Reaction

The result of this investigation will form the subject of a further publication.*

Conducting the Test.

It will be appreciated from what has been said concerning the occurrence and distribution of heterogenetic antibodies, that the Wassermann reaction must be carried out with strict attention to detail, and, indeed, because of its empirical nature, special care must be taken in quantitative preliminary standardisation of the reagents used.

It is not the intention of the writer to discuss in detail the methods employed, but attention must be called to the principles involved.

It should be noted here, that, as a result of careful combined clinical and laboratory observation, most of the difficulties arising in the test from the occurrence of heterogenetic pseudo-complexes, were eliminated, and reliable Wassermann reactions elaborated, before the import of heterogenetic pseudo-complexes was appreciated.

It was known that certain precautions had to be taken in the choice of reagents or the results were not reliable, but why these precautions were necessary was unknown.

Reagents.—I. *Sheep Cells* are usually employed as the cells of the indicator—phase 2—and while this reagent may be obtained by defibrinating the blood of any sheep at the slaughter-house, it is better to keep a sheep for this purpose in the animal house of the laboratory. This animal can be bled when required, so that cells from the same animal are always used, and furthermore, the anti-sheep-cell serum is actually prepared with cells from the same source as those which it will be used to sensitise.

In addition to this minor advantage there is another. "That the serum of certain guinea-pigs contains natural heterogenetic antibodies to sheep red cells, and the cells of sheep belonging to certain blood groups—sheep are divisible into blood groups in the same way as are human beings—are especially susceptible to this heterogenetic

* Lest this paper appear to suggest that all heterogenetic antibodies are of the hæmolytic type, it would be well to call attention to a reaction probably due to these but of a different type. The serum of patients suffering from typhus fever agglutinates certain strains of *B. proteus*, and although these micro-organisms certainly do not cause typhus, the reaction is so constant as to be of diagnostic import. It appears, then, that the reaction of the tissues of the virus of typhus calls forth a heterogenetic response which results in agglutination of *B. proteus*. This phenomenon is known as the Weil-Felix reaction.

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quality of guinea-pig serum." This may interfere to some extent with the preliminary standardisation of reagents, and, by testing the blood group of a stock sheep before purchase, this disturbing factor can be eliminated.

II. *Anti-sheep-corpuscle Serum*.—This reagent is obtained by injecting washed sheep corpuscles into normal rabbits. The important point concerning it is, that it must conform to a certain standard of activity. The rabbit serum is only the vehicle of a desired quality—ability to sensitise sheep cells—and what is aimed at is maximum sensitisation with minimum of vehicle.

If the rabbit serum used be too weak, one may be adding to the mixtures either natural, or induced, heterogenetic antibodies which could be disturbing factors either in the preliminary standardisation of reagents, or in the test itself.

The anti-sheep-cell serum must be of such strength that 0.001 c.c., or less, will sensitise 1 c.c. of a so-called 5 per cent. suspension of cells to the dissolving action of 0.05 c.c. of fresh normal guinea-pig serum. In this test pooled guinea-pig serum from several animals is used, so that the chance of using a complement rich in heterogenetic antibodies to sheep red cells is reduced to a minimum.

III. "*Antigen*."—This is usually a suspension of lipoids extracted from some animal organ, using alcohol for the extraction, and, before use, the suspension is in many cases enriched by the addition of cholestearin. The alcoholic extract and the alcoholic solution of cholestearin are diluted in saline for actual use in the test.

It is obvious that this reagent must be derived from some animal that does not possess marked heterogenetic qualities in respect of other constituents of the mixture in phase 1, and, therefore, the source of the lipoids should be human or ox organ, preferably heart.

For this reason an "antigen" should be tested with "complements" derived from several different guinea-pigs before it is employed for routine tests, in order to ensure that it is not liable to form pseudo-complexes with the serum derived from a relatively large percentage of these animals.

IV. *Complement*.—In most methods of conducting the Wassermann test, guinea-pig serum is the vehicle of complement.

As the activity of this reagent is or is not affected in phase 1 of the test, and, as alteration of that activity is to be shown in phase 2, complement deserves special consideration, for it is the critical constituent of the mixture in each tube.

Each time a test, or series of tests, is carried out this reagent must be critically scrutinised before it is employed.

(a) *Standardisation of Activity of Complement*.—If the complement is not up to a certain standard of activity, the results obtained

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are not reliable, and therefore one aims at using only those sera which are sufficiently active, for guinea-pig serum must be regarded only as the vehicle of complementary activity.

Normal guinea-pig serum not infrequently contains heterogenetic antibodies which form pseudo-complexes with other constituents of the mixture in phase 1, and the higher the concentration of guinea-pig serum, the greater the danger of introducing heterogenetic antibody in quantity sufficient to interfere with the delicacy of the test.

The necessary criterion of activity was arrived at by empirical observation before the reason for its being required was known.

(b) *Standardisation of Stability of Complement.*—In the previous section of this review attention was called to the fact that the serum of some guinea-pigs contains natural anti-human heterogenetic antibodies. If serum derived from such guinea-pigs be used as the vehicle of complement in a Wassermann test in which extract of human heart constitutes the "antigen," a pseudo-complex of "human heart lipoid plus guinea-pig serum" may result, and this will deprive the guinea-pig serum of its complementary activity.

We may have, then, a guinea-pig complement which conforms to the required standard of activity, but it may, owing to its possessing such heterogenetic antibodies, exhibit an instability or "hyperdeviability" in presence of "antigen" derived from human sources.

A preliminary "stability of complement" test is therefore introduced in order to overcome this difficulty, and only those complements which conform to a defined standard of stability can be used in the test.

It is found that if complement be mixed with "antigen" and the mixture incubated, there is always some diminution of its activity, and, using human-heart-lipoid enriched with cholestearin as the antigen, this diminution should not be greater than that represented roughly by the ratio 2/5. That is if in absence of antigen two arbitrary units of complement suffice, when mixed with a given quantity of sensitised red cells and forthwith incubated, to lyse these cells in a given time, not more than five of the same arbitrary units of the same complement should be required to lyse the same quantity of the same sensitised red cells in the same time, after exposure of the complement to the antigen under the conditions in which phase 1 of the test is to be carried out. A complement which does not conform to this standard of stability is useless.

V. *Serum to be Tested.*—This requires to be handled carefully, for, in some ways, it is unstable. The serum should be removed from the clot as soon as possible and should then be inactivated by heating to 56° C. for thirty minutes. It may now be stored in the ice-chest until the morning of the day on which the test is to be conducted,

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when it is again inactivated. Unless this be carefully attended to, certain sera develop anti-complementary qualities and will then *in absence of "antigen"* interfere with the activity of complement.

Some sera, even when most scrupulously attended to, exhibit this quality, and reports on such sera simply cannot be given.

It is therefore essential to set up a control of each serum in presence of complement, but in absence of "antigen," to eliminate this source of error.

The Test.—Reduced to its greatest simplicity, the test is set up thus:—

Inactivated serum to be tested is pipetted in the necessary quantity into two tubes "*a*" and "*b*."

A.—To "*a*" is then added a mixture of complement and "antigen," the concentration of these having been determined by preliminary standardisation of activity and stability of the former in presence of the latter.

B.—To "*b*" is added the same mixture of the same concentration of complement, but in this case the "antigen" is replaced by a corresponding quantity of saline.

"*a*" and "*b*" are then incubated for one hour at 37° C. To each is now added the requisite quantity of sensitised sheep cells, after which incubation at 37° C., preferably in a water bath, is continued for twenty to thirty minutes.

The cells added to "*b*" must be completely lysed, or no report can be given, those added to "*a*" are lysed if the reaction is negative, and are not lysed if the reaction is positive.

Interpretation of Results.

Unless the technique used be such that the actual amount of deviation of complement in the test can be expressed in "units" of complement only three types of report are permissible.

- (i.) "Definitely Positive."
- (ii.) "Definitely Negative."
- (iii.) "Partial—to be regarded as negative unless under active anti-syphilitic treatment."

This brings one to a consideration of the mental attitude of the worker responsible for the test, and this is of quite as much importance as the technique employed in conducting it.

The literature dealing with the Wassermann reaction shows that investigators have proceeded mainly along two lines. Some have attempted to modify the test with a view to simplifying its technique, and others have set out to make the test so delicate that it will serve to diagnose syphilis from the earliest primary manifestation of

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the disease to the final parasymphilitic condition which ultimately is the direct, or indirect, cause of death.

With regard to those researches that have had for their object the simplification of technique, it is to be noted that many of them have proved extremely valuable, but, on the other hand, certain modifications in the reaction which have evolved from them are not reliable, and much of this work will have to be carefully reviewed in the light of what is now known concerning heterogenetic complexes.

The other type of research which was designed to make the test as delicate as possible has also much to be said for it, but some of the attempts made in this direction have tended to make it too delicate. What we have to aim at is a technique, which, while giving a positive result in the vast majority of syphilitic cases, will *never* give a positive result in non-syphilitic cases.

The treatment of syphilis is a serious responsibility to assume, and if the attitude of the laboratory worker be "that it is his duty to protect the non-syphilitic from unnecessary treatment, rather than to diagnose every case of the disease, active and latent," he is on safe ground. If he sets out to get a 100 per cent. positive result rate in all types and stages of the disease, he will assuredly obtain positive results in non-syphilitics. Intensive anti-syphilitic treatment is not only inconvenient to the patient but it has an element of danger, admittedly slight, but none the less real.

The laboratory worker has no right to assume that his method is infallible, for, I repeat, that the test is essentially empirical and its basis is accurate—and therefore expert—clinical observation. On the other hand, the clinician has no justification for assuming that the result of the test is inaccurate simply because it does not agree with his view of a particular case, and, if the laboratory and the clinic are both efficient, it is really wonderful how infrequently are discrepant results obtained.

For this reason it cannot too strongly be urged that if in doubt concerning a result, the medical attendant should have the test repeated once, twice, or even three times if necessary. If the laboratory worker have a common-sense outlook he will welcome these repeated tests, for they come from the "border line" cases and they constitute the best control which can be obtained of the efficiency of the technique employed.

Another point must not be lost sight of—that two diseases can co-exist. Too often the surgeon or physician expresses the opinion that the Wassermann reaction is valueless because some individual patient whose blood gives a positive reaction and who *appears* to be suffering from syphilis, does not improve under syphilitic treatment:

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a patient with latent syphilis may well suffer from tuberculosis and he is by no means immune from neoplasms. It may seem unnecessary to call attention to this, but from lack of appreciation of this obvious possibility many troublesome "heresies" have arisen in connection with the test under discussion.

Two of these "heresies" deserve special note:—

(a) It has been stated that the serum from cases of chronic malaria gives a positive Wassermann. It is a little difficult to state the precise significance of a positive Wassermann in a case of chronic malaria; my own experience, admittedly limited, is that chronic malaria does not give a positive result unless the patient is also a case of latent syphilis, but it is only fair to say that during the last few months two papers have been published on this subject giving diametrically opposed results. In the first of these papers, of French origin, it is emphatically stated that, apart from syphilis, a positive Wassermann reaction does not occur in the serum of cases of chronic malaria. The second paper is equally emphatic that a positive Wassermann reaction does occur in chronic malaria, and therefore at the moment it is advisable, in all cases where chronic malaria is suspected, to have the test carried out both before and after a course of anti-malarial treatment. If, after treatment, the test remains persistently positive the evidence is that the case is one of syphilis.

(b) It has also been stated that serum from some cases of tuberculosis deviates complement in presence of a Wassermann "antigen." This is perhaps true up to a certain point, but, if the test is properly conducted, cases of tuberculosis, unless complicated by latent syphilis, never fix sufficient complement to deceive one as to how the result should be interpreted.

Among bacterial infections there is only one that gives a definite positive Wassermann—leprosy. On the other hand, certain protozoal infections are accompanied by a degree of alteration of the serum which leads to deviation, and often to marked deviation, of complement, in presence of a Wassermann "antigen." These conditions, however, do not seriously invalidate the test, and it may be said that in this country a positive Wassermann means syphilis, provided of course that the test has been conducted by a competent serologist, for the other factors which may lead to deviation of complement in presence of a Wassermann "antigen" are readily excluded.

Conclusion.

So much stress has been laid in this review on the essentially clinical basis of the Wassermann that it may well be asked—"If you are so insistent on this clinical basis and on the purely empirical

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character of the test, what is its use? Cannot all the information furnished by the test be obtained with equal accuracy, and with less difficulty, by clinical observation?"

The answer to these questions is that while stress has been laid on the clinical basis of the test it has been equally emphasised that the clinical observers supplying the basis must be expert observers *with a special knowledge of syphilis*. Syphilis is so protean in its manifestations that only those who have a knowledge of the multitude of ways in which it may affect the health of the individual who has acquired it, and, more important still, may affect the health of his or her offspring, can supply the information required for assessing the value of the test, and, to attain the necessary clinical exactitude involves experience which relatively few men are in a position to obtain.

Once the value of the test is thus determined, however, the whole of the experience of the expert is made at once available through the laboratory to every practitioner who cares to submit material for examination. *That is the real value of the Wassermann reaction.*

The present position of the test is that it is quite reliable if carried out with due care. It constitutes an extremely valuable adjuvant in the diagnosis of all cases of syphilis and it is especially valuable in arriving at a conclusion concerning the ætiology of a host of ill-defined, and apparently unrelated, clinical conditions varying from joint lesions supposed to be, and diagnosed as, tuberculous in origin on the one hand, to vague abdominal pains due apparently to no cause on the other.

ROYAL COLLEGE OF PHYSICIANS.

Report of Committee of the College regarding Interim Report submitted by the Consultative Council on Medical and Allied Services to the Scottish Board of Health.

In reviewing the Interim Report of the Consultative Council on Medical and Allied Services, the Committee of the College have kept in view the terms of the Reference from the Board of Health to the Consultative Council, as follows :—

“To consider and to make recommendations as to the systematised provision of such form of Medical and Allied Service as should, in the opinion of the Council, be available for the community.”

The Reference raises two issues which, although closely related, may with advantage be considered separately, viz. :—

(I.) What forms of Medical and Allied Services should be available for the community?

(II.) How best can the provision of such Services be systematised?

(I.) What forms of Medical and Allied Services should be available for the community?

The Committee of the College are in accord with the view of the Consultative Council that the present provision of such services throughout the community is inadequate and patchy. Hiatuses and irregularities exist which call for careful consideration.

The Committee note with satisfaction the definite recognition of the home and the household as the primary centre of medical care. From the medical, as well as from the social, point of view, the family is the normal unit. If the health of the nation is to be placed on a high level, the home must be the centre of medical endeavour, both preventive and curative. The family doctor, in immediate relation with the individual household, must be the instrument and agent of any scheme for the systematised provision of Medical and Allied Services. Households should be encouraged to look to the family doctor as their normal medical adviser and guardian to whom they naturally refer all matters pertaining to health, and who personally renders such services as he can, and likewise sees that auxiliary services otherwise provided are suitable and sufficiently brought within their reach.

It is, in the opinion of the Committee of the College, a primary and essential condition in the provision of extra medical services that the family doctor should be the medium of communication and

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arrangement in the case of households which are normally under his care. Only in this way can the continuous attention of the doctor to the well-being of the household be maintained and the interest of the community secured. Divorced from the family doctor as the ultimate health agent, attempts at the systematic provision of medical services are, in the judgment of the Committee, doomed to failure.

If the premise be conceded the way is clear to a useful consideration of the directions in which the efforts of the individual doctor may properly be supplemented by extra services duly systematised.

Provision for such extra services has already been made in certain directions, but in piecemeal and unequal fashion. In connection with some of these it may fairly be questioned if sufficient care has been taken to secure the friendly concurrence and co-operation of the family doctor in the way which seems to the Committee essential for success. Obvious examples of the lack of proper co-ordination are to be found in connection with the Education Medical Services and Child Welfare and Maternity Schemes.

Such agencies affect the heart of family life and their operation can only be successful when intimately linked with those of the family adviser. It is most desirable that any machinery for the betterment of the community erected outside the individual home should be brought into intimate relationship with the operation of the doctor within the home. The doctor should be a party to all communications and measures proposed in the interest of the members of the household.

No one knows better than the family doctor the lacunæ which exist in his armamentarium for the suitable treatment of various patients at varying stages of illness, nor will any one be more appreciative of sound proposals whereby the deficiencies can be made good.

The Committee of the College are unanimously of opinion that the facilities presently available for the care and treatment of sick persons throughout the country call for improvement and expansion in numerous directions. They recognise that existing needs differ somewhat in different parts of the country. The needs of a densely populated centre of industrial life are different from those of a scattered rural area. In this respect the needs of the Highlands and Islands call for particular consideration.

The Recommendations of the Consultative Council are evidently based on a careful review of the available evidence. The Committee of the College have gone over the Recommendations in detail and are generally in agreement with the proposals, provided that the relation of the family doctor to the extra medical services be safeguarded and that certain conditions, as to the mode of provision and systematisation of such services, be fulfilled.

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The Committee of the College desire to reinforce the position that a great improvement might be effected in relation to the immediate treatment of illness and to the prevention of disease by a thorough-going reform of housing conditions and particularly by the education of the inmates as to how to make the best use of the dwelling-house.

The Committee approve of the Recommendation of the Council that certain services involving special skill or equipment, which are essential for successful medical treatment, and are at present beyond the reach of certain classes of the community, should be made available to all.

In this sense the Committee approve of the suggested provision of special accommodation for cases of illness, either acute or chronic, which, while not requiring special surgical or other skill, cannot in the judgment of the doctor be adequately treated in the patient's own home. This arrangement would have the added advantage of facilitating the work of sick nursing.

While really serious surgical cases would, for the most part, continue to be sent for operation to hospitals or homes, it seems right that supplementary professional advice and assistance should be made available to doctors in connection with graver cases of illness occurring in their practice and continuing under their care. Some scheme for the simplification and facilitation of medical and surgical consultation throughout the country is most desirable. It seems unnecessary at this stage to enter into detailed consideration of the proposed plan. In the opinion of the Committee this may safely be left to gradual development along natural lines, according to the needs and possibilities of the several areas.

The Committee are in hearty agreement with the Council's recommendation in favour of the provision of adequate laboratory facilities, and especially the bringing of these more uniformly within easy reach of practitioners throughout the country. It seems natural that in some areas such facilities might be associated with local clinics. Here also the detailed Scheme outlined in the Report must evidently be a matter of gradual development.

The Committee are unanimously in favour of the extension of the principle of Convalescent Homes in connection with the hospitals of the country. This would notably ease the strain on hospital accommodation, and obviate the many disadvantages presently attaching to the system of waiting-lists, which seriously limit the value of the larger hospitals.

Apart from the needs of hospitals, it would be an immense boon to the general practitioner to have more closely at his service Convalescent Homes for the behoof of persons recovering from serious illness involving long convalescence. Much may be said

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likewise for the provision of country rest homes to which persons suffering from the strain of work, or other cause, might be sent with a view to anticipate illness, or prevent more serious breakdown.

No argument is needed to enforce the value to the patient and to the doctor as to the extension of the methods of district nursing. The Queen Victoria Jubilee Nurses' Organisation has brought incalculable benefit to the community, and the voice of the profession is unanimous in pressing for a still larger development along such lines. What the rich can afford for themselves in this direction should be made available to all. No greater immediate service could be rendered to the country by the Board of Health than the placing of the Queen Victoria Jubilee Organisation on a larger and more stable basis.

The proposal for an elaborate service of Health Visitors, apart from such nurses, is little favoured by the Committee. The experience of a good many members of the Committee is strongly adverse to the methods of this Service as hitherto developed. The Committee are unanimously of opinion that Health Visitors should, in all cases, have enjoyed nursing training.

With regard to maternity, the Committee favour the view that provision must be made whereby skilled medical guidance is available for every expectant mother. For the most part this should be attained by way of the family doctor, who in many directions may be the means of ensuring safe gestation and anticipating trouble. The doctor would be suitably aided by a service of midwives who may frequently, in cases of normal labour, replace the doctor. In view of the occurrence of difficult cases, or where the home is obviously unsuitable, it is desirable that a sufficient number of maternity beds should be available in every district.

The Committee concur in the Council's Recommendation that adequate facilities should exist throughout the country for conservative dentistry.

(II.) Assuming that an expansion of Medical and Allied Services such as has been outlined should be afforded, a further question arises as to the method whereby the Services should be made available.

How best can the provision of such Services be systematised?

The Committee would remind the College that the Board of Health, as now constituted, represents the centre of co-ordination for purposes of direction and administration of all the public Services and agencies concerned with the health of the community.

The College has on various occasions urged the desirability of a complete and systematised centralisation of health activities. The Consultative Council on Medical and Allied Services, whose Interim Report is now under consideration, is an important auxiliary of the

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Board. The College gave its concurrence to the constitution of the Council by recommending certain persons for inclusion in its membership.

Whatever conclusions the Board of Health may come to, after consideration of the views of the Consultative Council, and of other bodies who may volunteer suggestions as to the policy to be followed in the interest of the health of the community, it is obvious that a successful issue will chiefly depend on the just adaptation and smooth running of the machinery whereby the policy is put into practice throughout the country.

If such co-ordination of Services and agencies be essential at the centre, similar co-ordination is no less necessary throughout the country and particularly at the periphery. The Committee of the College cordially endorse the plea of the Consultative Council in pressing for a unification of the various Local Authorities concerned with health and treatment in each district. Such unification is the first step towards a successful systematisation of Medical Services.

Locally as well as centrally the various agencies concerned with the direction and maintenance of Health Services must be closely linked up.

The question whether this should be effected by enlargement of the presently existing Health Committees of Local Authorities so as to include in their membership a larger proportion of competent persons—by reason of training and experience—or by the creation of a special Local Authority—erected *ad hoc*—hardly rises for consideration here.

The Committee would, however, emphasise the opinion that ultimately the success of the Board of Health's policy will largely depend on the extent to which the policy embodies the principle that the Health Service of the nation, however elaborated, should be based on the family doctor as the medical attendant and guardian of the household, and that, whatever extra services are provided, should be conceived as supplemental and auxiliary to his efforts.

In endorsing the above recommendations made by the Consultative Council the Committee of the College would not have it supposed that they look for the immediate realisation of the details outlined in the Scheme of Medical Services proposed in the Report. The present economic condition of the country makes this manifestly impossible. It is, in their opinion, none the less important that a beginning be made and sound foundations laid for the gradual development later as circumstances may permit.

Lastly, in relation to financial considerations which hardly come within the terms of the Reference, it seems pretty clear to the Committee that, while the wealthier classes can already attain most of the advantages which are now claimed for all, it will be found that for

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a certain section of the community, fairly described as necessitous, the provision of all Medical Service will have to be made at the public expense. It seems no less clear that the costs of Medical Services as expanded in the way that has been outlined—which will be necessarily considerable—might, for a large intermediate group between the wealthy and the necessitous, be met by a Scheme of graded contribution either voluntary or enforced by statute.

The Committee think it proper to add that some members of the Committee, in adhering to the Committee's Report, object to an extension of Medical Benefits under the National Health Insurance Acts to dependants of the insured population except on a basis of voluntary contribution, while some desire to place on record their continued disapproval of the conditions of service under the medical benefit section of the National Health Insurance Acts.

In name and by authority of the Committee,

J. S. FOWLER,
Secretary.

*The above Report was adopted at the last quarterly meeting
of the Royal College of Physicians.*

ROYAL COLLEGE OF SURGEONS OF EDINBURGH.

Higher Dental Diploma—

The following candidates having passed the requisite examinations received the Higher Dental Diploma:—Grantley Smith, L.D.S., R.C.S. (Eng.), Enfield, Middlesex; James Alfred Snarey Wright, L.D.S., R.C.S. (Eng.), London.

Bathgate Memorial Prize—

At a meeting of the Royal College of Surgeons of Edinburgh, held on 18th instant, the Bathgate Memorial Prize, consisting of bronze medal and set of books was, after a competitive examination in *Materia Medica*, awarded to James Maitland M'Lintock, and the Ivison Macadam Memorial Prize in Chemistry, consisting of bronze medal and set of books was awarded, after competitive examination, to John Harkness.

Fellowship Examination—

At a meeting of the College held on 18th May, the seventeen successful candidates out of fifty-six entered, who passed the requisite examinations between 10th and 15th January 1921, were admitted Fellows:—John Phillips Blockley, M.B., Ch.B. (Edin.), Shrewsbury;

Royal College of Surgeons

John William Burns, M.B., B.Ch., B.A.O., M.D. (Dublin), Liverpool ; Arthur Cruchy Clark, M.B., Ch.B. (Edin.), Edinburgh ; William Alexander Cochrane, M.B., Ch.B. (Edin.), Edinburgh ; Thomas Colley, M.B., Ch.B. (Vict. Univ., Manch.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), Lytham, Lancashire ; Cyril Charles Herbert Cuff, M.B., B.S. (Durham), M.R.C.S. (Eng.), L.R.C.P. (Lond.), St Lucia, British West Indies ; Charles William Graham, M.B., Ch.B. (Edin.), Lerwick, Shetland ; John Mickle Hyde, M.B., B.S. (New Zeal.), Waiki, New Zealand ; Victor John Frederick Lack, M.R.C.S. (Eng.), L.R.C.P. (Lond.), B.S. (Lond.), London ; Thomas Lindsay, M.B., Ch.B. (Edin.), Perth ; Helen Meldrum M'Millan, M.B., Ch.B. (Edin.), Edinburgh ; Walter Mercer, M.B., Ch.B. (Edin.), Stow, Midlothian ; Mabel Lida Ramsay, M.B., Ch.B., M.D. (Edin.), D.P.H. (Cantab), Plymouth ; George Clifford Scantlebury, M.B., B.S. (Melb.) ; Stuart Scoular, M.B., Ch.B. M.D. (Univ. New Zeal.), Waimate, New Zealand ; George Henderson Stevenson, M.B., Ch.B. (Edin.), D.P.H., R.C.P. & S. (Eng.), M.R.C.P. (Edin.), Cardonald, near Glasgow ; Stanley George Whitfield, M.B., Ch.M. (Sydney).

Diploma in Public Health—

At the recent Examination of the Board of the Royal College of Physicians of Edinburgh, Royal College of Surgeons of Edinburgh, and Royal Faculty of Physicians and Surgeons of Glasgow, the following candidates, having passed the requisite examinations, were admitted Diplomates in Public Health:—Robert Boog Watson, M.B., Ch.B. (Edin.) ; Robert Bell Stewart, M.B., Ch.B. (Edin.) ; Cecil Carron Brown, M.B., Ch.B. (Edin.) ; John Stephen Elliot, M.B., Ch.B. (Edin.) ; John Boyd Primmer, M.B., Ch.B. (Edin.) ; Donald Arthur Cadman, M.B., Ch.B. (Edin.) ; Andrew Inglis Meek, L.R.C.P. & S.E., &c. ; Jamit Singh, M.B., B.S. (Univ. Punjab) ; John Cormack Simpson, M.B., Ch.B. (Edin.) ; Norman Stanley Lees Lorraine, M.B., Ch.B. (Edin.) ; Colin Milne, M.B., Ch.B. (Edin.) ; George Graham Shaw Johnston, M.B., Ch.B. (Edin.) ; David Torquil Macleod Large, M.B., Ch.B. (Edin.) ; George Pritchard Taylor, M.B., Ch.B. (Edin.) ; Jane Elizabeth Hay, M.B., Ch.B. (Edin.).

NEW BOOKS

The Sphygmometer, Its Value in Practical Medicine. By WILLIAM RUSSELL, M.D., LL.D. Pp. xii + 145, with 14 illustrations. London: Baillière, Tindall & Cox. 1921. Price 7s. 6d. net.

Certain clinical lectures delivered by the author, and published in medical journals between the years 1908 and 1916, together with his George Alexander Gibson Memorial Lecture delivered in 1920, are now presented in one volume. The author, as is well known, was one of the earliest writers in this country on the use of the sphygmomanometer, and it is to him more than to anyone that we owe our knowledge of arterial hypertonus, of cerebral angiospasm, and of the true significance of high sphygmomanometer readings. The book presents an admirable picture of the protean clinical manifestations of arterio-sclerosis, and due regard is constantly laid upon the importance of recognising the manner in which the arterial changes originate and the methods to be adopted for the treatment of patients who are suffering from hypertonus, whether the arteries be healthy or sclerosed. Amongst the remedies advocated by the author are physical rest, low diet, daily bowel evacuation, radiant-heat baths, erythrol tetranitrate, spirit of nitrous ether, the iodides and alkalies combined with squill if the heart needs stimulation. Purgation is to be avoided save in the urgent cases, but in extreme cases blood-letting is useful.

The book is one that will be of much value to the physician and general practitioner. Its practical utility would have been enhanced by an ampler consideration of diastolic pressure, and by the inclusion of an index.

The Care of Human Machinery. By R. M. WILSON, M.B., Ch.B. Pp. viii + 238, with 18 charts. London: Henry Frowde and Hodder & Stoughton. 1921. Price 10s. 6d. net.

This is one of the Oxford Medical Publications and most opportunely does it arrive. Industrial unrest can only be settled when masters and men sit down together to discuss the problems so interestingly and ably discussed in the book before us. It is not exclusively a book for medical men. Laymen, masters, and servants should study its contents. It is full of suggestion, and for that reason all the more interesting. The author knows what he is talking about and he convinces his reader of the fact. The care of the human machine is actually the text underlying the twenty-two chapters which deal with a subject that is bound to force its urgency upon employers at no distant date. A healthy worker will and must produce good work. A weakly person cannot. *Mens sana in corpore sano* is the theme of Dr Wilson's discussions.

BOOKS RECEIVED

ANNALS OF MEDICAL HISTORY. Vol. III., No. 1		
	(<i>Baillière, Tindall & Cox</i>)	\$8 per vol.
ANSPACH, BROOKE M. Gynecology	(<i>J. B. Lippincott Company</i>)	42s.
ARVEDSON, J. Notes on Diseases Treated by Medical Gymnastics and Massage	(<i>J. & A. Churchill</i>)	8s. 6d.
BALLANTYNE, J. W. Encyclopædia Medica. Second Edition. Vol. VII.	(<i>W. Green & Son</i>)	—
BENNETT, REGINALD R. Materia Medica and Pharmacy. Fourth Edition	(<i>H. K. Lewis & Co., Ltd.</i>)	7s. 6d.
CARRUTHERS, THOMAS. Urine Examination Made Easy. Fourth Edition	(<i>J. & A. Churchill</i>)	2s.
COOK, WILLIAM G. H. Insanity and Mental Deficiency in Relation to Legal Responsibility	(<i>Routledge & Sons, Ltd.</i>)	10s. 6d.
CRAIG, C. F. The Wassermann Test. Second Edition	(<i>Henry Kimpton</i>)	25s.
DAVIS, EDWARD P. Mother and Child. Fourth Edition	(<i>J. B. Lippincott Company</i>)	12s. 6d.
ELLIOT, R. H. The Care of Eye Cases	(<i>Oxford Medical Publications</i>)	12s. 6d.
GABELL, DOUGLAS. Prosthetic Dentistry	(<i>Oxford Medical Publications</i>)	12s. 6d.
GAMMONS, HERBERT F. Practical Tuberculosis	(<i>Henry Kimpton</i>)	10s. 6d.
GUTHRIE, DOUGLAS. Diseases of the Ear, Nose, and Throat in Childhood	(<i>Adam & Charles Black</i>)	5s.
HAUBOLD, HERMAN A. The Principles and Practice of Surgery. In two vols.	(<i>D. Appleton & Co.</i>)	48s.
HERTZLER, ARTHUR E. Clinical Surgery by Case Histories. In two vols.	(<i>Henry Kimpton</i>)	£5
HEWLETT, R. TANNER. A Manual of Bacteriology. Seventh Edition	(<i>J. & A. Churchill</i>)	21s.
LANKESTER, ARTHUR. Tuberculosis in India	(<i>Butterworth & Co. (India), Ltd.</i>)	10s.
MACARTHUR, JOHN. Mental Hospital Manual	(<i>Oxford Medical Publications</i>)	15s.
M'CARRISON, ROBERT. Studies in Deficiency Disease	(<i>Oxford Medical Publications</i>)	30s.
MARSHALL, CHARLES E. Microbiology: A Text-book of Micro-organisms, General and Applied. Third Edition	(<i>J. & A. Churchill</i>)	21s.
MORROW, ALBERT S. Diagnostic and Therapeutic Technic. Third Edition	(<i>W. B. Saunders Co.</i>)	40s.
MYERS, V. C. Practical Chemical Analysis of Blood	(<i>Henry Kimpton</i>)	16s.
NEWELL, FRANKLIN S. Cæsarean Section	(<i>D. Appleton & Co.</i>)	—
NORRIS, CHARLES C. Gynecological and Obstetrical Tuberculosis	(<i>D. Appleton & Co.</i>)	—
NOVAK, EMIL. Menstruation and its Disorders	(<i>D. Appleton & Co.</i>)	—
OPIE, E. L., BLAKE, F. G., SMALL, J. C., and RIVERS, T. M. Epidemic Respiratory Disease	(<i>Henry Kimpton</i>)	36s.
POLAK, JOHN O. Pelvic Inflammation in Women	(<i>D. Appleton & Co.</i>)	—
RUSSELL, WM. The Stomach and Abdomen	(<i>Baillière, Tindall & Cox</i>)	15s.
SCHUMANN, EDWARD A. Extra-Uterine Pregnancy	(<i>D. Appleton & Co.</i>)	—
SINGER, CHARLES. Studies in the History and Method of Science. Vol. II.	(<i>Clarendon Press</i>)	48s.
SMITH, A. RAMSAY. Sanitation in Country Places	(<i>Rogers, Adelaide</i>)	—
TRANSACTIONS OF THE AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS. Vol. XIII. 1920	(<i>Williams & Wilkins Coy., Baltimore</i>)	—
VARIOT, G. Traité pratique des Maladies des Enfants	(<i>Doin, Paris</i>)	Frs. 75

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RIB PRESSURE AND THE BRACHIAL PLEXUS.*

By EDWIN BRAMWELL and HAROLD B. DYKES.

Introductory.

A SERIES of cases met with during the past few months has directed our attention to the question of brachial plexus palsies due to rib pressure. Since no communication upon this subject has hitherto been presented to the Society, the following résumé, which embodies references to our personal experience, may prove of interest. The fact that the senior writer has records of twenty-three instances in which he has made a diagnosis of brachial plexus disturbance dependent upon rib pressure indicates that these cases are not uncommon. Brief reference to four cases will serve to illustrate some of the problems to which it is proposed to refer in the present communication.

CASE I. Complete Bilateral Cervical Ribs ; no Pressure Symptoms.—A female, 32 years of age, unmarried, who complained of dyspeptic symptoms, was found in the course of examination to present a bilateral prominence above the clavicle. The subclavian artery was situated high in the neck, and a loud systolic murmur was audible beyond the point at which the artery passed over the prominence above mentioned. On radiographic examination a very complete cervical rib was demonstrated on either side. This patient presented no symptoms indicative of pressure upon the brachial plexus.

CASE II. Unilateral Pressure Symptoms : no Cervical Rib. Removal of First Dorsal Rib ; Recovery.—A typist, 24 years of age, had been troubled for seven years with pain along the inner side of the left forearm which had necessitated her giving up her occupation. Upon examination, some weakness of the left hand and slight

* Communicated to the Medico-Chirurgical Society of Edinburgh, 2nd March 1921.

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flattening of the thenar eminence were observed. Tenderness was complained of on pressure in the region of the transverse process of the seventh cervical vertebra on the left side. No definite sensory loss was detected nor was any difference between the radial pulses noted. The X-ray examination showed no evidence of a rib anomaly, although the transverse processes of the seventh cervical vertebra on either side were somewhat prominent. Rib pressure was diagnosed and Sir Harold Stiles decided to remove a portion of the first rib, an operation which was followed by immediate disappearance of the pain and by gradual improvement in the motor weakness.

CASE III. Unilateral Paresis of Intrinsic Muscles of Hand and Flexors of Fingers; Onset during an Attack of Diphtheria; well-developed Cervical Rib. Possibility of an Infective Factor.—A girl, 16 years of age, was admitted to hospital suffering from an extensive post-diphtheritic neuritis. In addition to paralysis of the palate, dysphagia, defective accommodation, and some paresis of both the lower and upper limbs with loss of the deep reflexes, pronounced weakness of the intrinsic muscles of the right hand and some weakness of the flexors of the fingers was noted. There was no definite wasting of the hand muscles, no pain in the arm had been complained of, and no objective sensory disturbance was detected. Unilateral paralyses are very unusual as a sequel of diphtheria, and yet in the present case no weakness of the hand had been noticed prior to the onset of the fever. A lesion of the lower cord of the brachial plexus was indicated by the distribution of the motor weakness. The right radial pulse was found to be "smaller" than the left, and upon examining the neck the presence of a distinct prominence on the right side, obviously caused by a supernumerary rib, was observed. Upon X-ray examination a well-developed cervical rib was found upon the right, a rudimentary rib on the left side. When seen some months after her discharge from hospital there was still slight weakness of the right hand, though the other paralyses had been completely recovered from.

Symptoms due to rib pressure vary in intensity and character in different cases. The surgeon meets especially with a type of case in which the symptoms, notably pain, are severe, and in which a cervical rib has been previously diagnosed or at least suspected; while in the majority of those cases seen by the physician the possibility of rib pressure has not, as a rule, been previously thought of, the case having been regarded, it may be, as one of "neuralgia," "neuritis," or "progressive muscular atrophy." Cases are probably not infrequent in which the

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symptoms are so slight in degree that the practitioner is never consulted, and, even if he is, the significance of the symptoms may not be appreciated. The following case, in which the symptoms were comparatively insignificant, is an instance in point :—

CASE IV. *Slight Symptoms of Rib Pressure ; no Cervical Rib.*—

A married woman, 32 years of age, had since her schooldays complained at times, particularly when she was “run-down,” of pain above the right clavicle. She stated that the pain occasionally passed down the inner side of the forearm, and that she was sometimes wakened by this pain during the early hours of the morning. At these times she had often experienced a feeling of “pins and needles” in the little and ring fingers of the right hand. The pain, she stated, was almost immediately relieved when she raised the arm above her head; further, she said that when playing lawn tennis and making a forcible stroke, her grasp would sometimes give way and the racquet would spin from her hand, much to the amusement of her companions. Neither motor weakness nor sensory loss was detected, the pulses were equal, and there was no evidence of a cervical rib; there was, however, constant tenderness on pressure in the region of the transverse process of the seventh cervical vertebra on the right side. No doubt the symptoms in this case were determined by rib pressure.

The cases above referred to raise the following questions among others :—What is the biological significance of a cervical rib? Why is it that a particularly well-developed cervical rib is often (? usually) unaccompanied by pressure symptoms, while in other cases pressure symptoms are met with in the absence of any obvious rib anomaly? What are the factors which determine the incidence of pressure symptoms? Why are pressure symptoms so much more frequent in women than in men, and especially in young women? Is it possible to diagnose “rib pressure” in the absence of any detectable abnormality of the ribs? When is operation indicated for the relief of rib pressure, and what are the results of operation?

The Cervical Rib.

The presence of a supernumerary rib or pair of ribs was, it is affirmed,² noted by Galen. Hunauld, who published a paper in 1742, is credited by Keen¹⁴ as the first observer to definitely describe this abnormality; a monograph by Gruber,⁹ published in 1869, is said by Borchardt² to afford a very complete account

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of the anatomical features of these ribs. Pilling,¹⁹ in 1894, collected 139 cases, of which 9 had been recognised during life.

Several distinguished members of this School and of this Society have contributed to our knowledge of the cervical rib. Thus Sir William Turner,²⁹ who in 1870 reported 7 cases, remarks that cervical ribs may occur in both sexes and at all ages, even in an embryo of six months. "Cervical ribs," he says, "may be either the unusually developed rudiments of the anterior transverse process or rib of the seventh cervical vertebra or merely unusually developed epiphyses articulating only with the transverse process of the seventh vertebra." Sir John Struthers,²³ five years later (1875), writing upon "variations of the vertebræ and ribs in man," records a number of instances and two cases in which cervical ribs were recognised in the living subject. He notes that when the cervical rib has developed some way beyond the vertebra it assumes a surgical importance, and he refers to the case of a medical man, mentioned to him by Professor Syme in 1853, in whom an aneurism of the subclavian artery had been suspected. Further, he observes that there is a slight preponderance among females. Professor Symington,²⁴ in 1882, demonstrated at a Meeting of this Society a cervical rib which he had met with in the dissecting-room, and he showed at the same time a medical student in whom a cervical rib was recognisable. Sir David Wallace,³⁰ in 1891, communicated a valuable paper to the Society entitled, "On Cervical Ribs, with an Example in the Living Subject." This paper may be consulted for a review of the older literature. Among other points of interest, Wallace remarks that if the cervical rib joins the cartilage of the first thoracic rib, the anterior scalene muscle may be attached to it and the subclavian artery groove its upper surface, while he states that in Professor Symington's case the eighth cervical and first dorsal roots passed over the rib. In presenting a patient who exhibited signs indicative of cervical rib, he makes the interesting observation that to the most internal part of the prominence in the neck a band is attached, but whether this is muscular or fascial it is, he states, difficult to say. This reference is of special interest in view of the importance now attached by some observers to this band as a cause of pressure symptoms. The subclavian artery in this case was felt pulsating most distinctly immediately in front of the extremity of the cervical rib, but no pulsation could be detected external

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to the point of the rib; the radial pulse is not referred to. Finally, the author concludes, "the presence of a cervical rib ordinarily is not troublesome to the possessor, but where the artery is high an injury to the vessel might very readily occur." Professor Caird,⁶ in discussing this paper, remarked that he had seen what he believed to be two cases of cervical rib, in one of which an aneurism was simulated on the left side of the root of the neck in a woman, and a second with which a neuritis and obliteration of the radial pulse were associated. The latter must have been one of the earliest cases in which such symptoms were attributed to pressure by a cervical rib. Sir Harold Stiles,²¹ in 1895, brought before the Society a female child, aged 18 months, with a well-marked cervical rib on the left side. The pulsation in the subclavian artery could not be felt, hence he concluded that the vessel was lying anterior to the extremity of the cervical rib and was not arching over it. He remarked that in all some eight or ten cases had been recorded (five during that year) in which a cervical rib had been excised in consequence of pressure upon the brachial plexus or the subclavian artery or upon both.

The anatomical characteristics of cervical ribs are admirably described by Sir William Thorburn²⁶ as follows:—"More or less well-developed ribs are not infrequently met with in connection with the seventh cervical vertebra, the condition being generally bilateral; in very rare cases the sixth vertebra also carries ribs, and four may thus be present in one neck. Occasionally the 'rib' is a mere epiphysis, articulating only with the transverse process of the vertebra, but more commonly it is a developed anterior transverse process and consists of a definite head, neck and tubercle, with or without a body. If no body be present it does not project beyond the transverse process of the vertebra, but in the more fully developed cases it extends outwards, or forwards and outwards, into the posterior triangle of the neck, where it may terminate in a free end or may join the first dorsal rib, the first costal cartilage, or the sternum. Posteriorly the rib articulates in the usual manner with the body and transverse process of the seventh cervical vertebra. When it terminates in a free end it is bony throughout; to the first dorsal it may be united by dense, fibrous tissue, or by a joint with an articular cartilage and synovial membrane: junction with the sternum is by cartilage which unites with the first dorsal cartilage. The first dorsal rib often bears a well-defined bony tubercle

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with which is articulated the distal end of its cervical companion. The *shape* of the rib varies much in different cases: in some it is long, thin, and pointed; in others it is broad and flat, very closely resembling a first dorsal rib, and when thus flattened its edges are often very sharp; when large enough and so placed as to lie in contact with the brachial plexus or subclavian artery, it often presents on its upper border a groove for the lodgment of these structures. The *length* presents as great a variation as the shape; thus the abnormal bone may be so short as only to project slightly beyond the cervical transverse process, or it may curve round the neck, running a course of some inches before it joins the sternum or first dorsal rib. In this connection skiagrams are naturally quite misleading, as a short rib standing horizontally outwards will be very prominent, whereas a much larger bone, if flat and curved upon itself, will be comparatively inconspicuous. Of equal importance with the size and shape of the rib is its *direction*: when running outwards it will completely avoid the nerves and vessels of the neck and will not produce clinical symptoms other than deformity; it is only when the bone curves round in the posterior triangle that it is liable to lead to trouble, and its shape and direction are thus doubtless of more importance to the clinician than its mere size." . . . "The *mobility* of the rib is also important for the surgeon and possibly in connection with the etiology of symptoms; where the bone has no anterior attachments, its vertebral articulation allows fairly free movement, but when the arch is completed and there are connections with the first dorsal rib or sternum, these are very strong and the bar is rigidly fixed at both ends." . . . "The *subclavian artery* only comes into relationship with the rib when the latter has a sufficient length and curve to reach the anterior part of the neck, but there is no absolute rule as to what this length must be. In all cases the artery, if it has any relation to the rib, passes *over* it."

The best classification of cervical ribs is, according to Keen,¹⁴ that of Gruber into four degrees, viz.:—"First degree, a very slight increase of the costal process, not reaching beyond the true transverse process. Second, a rib protruding beyond the transverse process to a moderate extent and ending either free in the tissues or attached in some way to the first thoracic rib. Third, a still further degree of development in which the cervical rib extends for a considerable distance toward or even

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to the cartilage of the first thoracic rib, possesses a complete body, and is united directly or by means of a ligament with the cartilage of the first rib. Fourth, a complete cervical rib uniting at the anterior extremity with the cartilage of the first rib through which it reaches the manubrium."

A cervical rib is, as Keen¹⁴ remarks, a congenital vice of development, and, as might be expected, other congenital abnormalities are occasionally found in association with it. *Scoliosis*, on account of the frequency of its occurrence, calls for mention in this connection. Thus Schönebeck, whose observations are referred to by Keen, records in a Strassburg Dissertation published in 1905, the presence of scoliosis in twenty-two of sixty-one cases collected from the literature, while Drehmann presented an important paper on this form of scoliosis at the Congress of the German Orthopædic Association in 1906 (Keen). A pronounced scoliosis was present in one and a slight degree in two of Hinds Howell's¹⁰ sixteen cases, but in none of our cases was this condition noted.

Recognition of Rib Pressure as a Cause of Symptoms.

Rib pressure has only come to be generally recognised as a cause of symptoms within the past fifteen or twenty years. Prior to this time, cervical ribs had, it is true, been occasionally detected during life, while in exceptional instances, as in the case referred to by Caird,⁶ symptoms had been correctly attributed to their presence; a small number of cases had indeed been operated upon. Sir Rickman Godlee,⁸ for example, mentions the fact that Lord Lister many years ago operated upon a case of the kind. Advance in knowledge may be said to have taken place in two directions: firstly, by the observation of a group of cases characterised by localised motor and sensory symptoms which were proved to correspond to a nerve-root distribution; and, secondly, by the application of the X-rays, whereby the observer was enabled to detect the presence of rib anomalies, previously unrecognisable by the ordinary methods of examination.

Thus, Lewis Jones,¹¹ in 1893, recorded six cases of "Symmetrical Atrophy affecting the hands in young people." He pointed out that in these cases the atrophy was confined to the small muscles of the hands, that some of the muscles affected were supplied by the median and some by the ulnar nerve, and that the wasting remained limited to these muscles

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and did not go on to a progressive muscular atrophy. These cases were demonstrated before the Neurological Society of London, but no explanation was at the time suggested which would satisfactorily account for the muscular wasting.

Farquhar Buzzard,⁴ nine years later (1902), described certain cases of what he termed "Uniradicular palsies of the brachial plexus." The distribution of the muscular atrophy in three of these cases, although unilateral, was similar to that observed in the group just referred to, while in addition there was an area of sensory loss dissociative in character along the inner side of the forearm. Buzzard concluded that the muscular wasting and sensory loss were due to a lesion of an individual nerve-root of the brachial plexus. With regard to the etiology of these cases he remarks, "The condition generally occurs in persons who have at some time been the subjects of a disease affecting the cardio-vascular system. The morbid process is probably vascular in character and may be sudden or gradual in its onset."

A case reported by one of us (E. B.)³ in 1903, under the title of "Lesion of the First Dorsal Root," is of some historical interest, since we know of no case published previously in which a diagnosis of rib pressure had been suggested as a possible cause of symptoms in the absence of evidence of a cervical rib, or in which the suggestion had been advanced that symptoms might be due to injury to the first dorsal nerve-root by a normal first dorsal rib.

CASE V. *Unilateral Symptoms; no Cervical Rib. Case reported in 1903, as "Lesion of the First Dorsal Nerve Root"; Symptoms "possibly suggestive of Pressure on the Root; . . . Intimate Relationship of the First Dorsal Nerve Root to the Sharp Internal Border of the First Rib; . . . such a Relationship can hardly fail to predispose the Root in an Especial Manner to Traumatism."*—The patient, a lad aged 18, stated that for three or four years he had from time to time been troubled with pain passing down the inner side of the right forearm, that his right hand had been gradually wasting and that it constantly felt cold. In reporting this case we remark: "The absence of any sensory impairment in the hand and the fact that the motor weakness is incomplete is strong evidence in favour of the view that the lesion is limited to the first dorsal root, *i.e.*, that the first dorsal root is involved before its junction with the eighth cervical. The absence of oculo-pupillary symptoms indicates that the lesion has implicated the first dorsal root beyond the point where the sympathetic fibres leave it." This patient, in whom there was

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no evidence of cardio-vascular disease, attributed his condition to lifting heavy weights (he had frequently in the course of his work to lift a 56-pound weight). Finally we remark, "The pain down the inner side of the forearm from which he had suffered for two or three years before any weakness was noticed in the hand is possibly suggestive of pressure on the root. In this connection it is interesting to note the intimate relationship of the first dorsal nerve-root to the sharp internal border of the first rib. Such a relation can hardly fail to predispose the root in an especial manner to traumatism." The possibility of a cervical rib had occurred to us, but Mr J. W. Struthers, who also saw the patient, agreed that there was no evidence of this abnormality.

Sir William Thorburn²⁵ read a paper before the Royal Medical and Chirurgical Society of London in April 1904, when he described two cases in which atrophy of the muscles of the hand and sensory disturbance were associated with cervical ribs, the presence of which had been definitely established by X-ray examination. Thorburn was, so far as we know, the first observer in this, and perhaps, with the exception of Borchardt, in any other country to apply the Röntgen rays to this problem in diagnosis. He indicates in his paper the close resemblance between the symptoms in these cases in which a cervical rib was demonstrable by the X-rays and those observed and recorded by Farquhar Buzzard and ourselves as examples of uniradicular paralysis of the brachial plexus. Upon reading this paper we had several X-rays taken of our case with a negative result. Shortly after the publication of Thorburn's paper, Lewellys Barker,¹ who had in 1896 made an elaborate investigation into certain sensory manifestations in his own arm which were associated with what was regarded as a probable cervical rib, informed us that in his case the presence of a cervical rib had been definitely proved by the X-rays.

After the appearance of Thorburn's paper, Lewis Jones¹² directed his attention once more to the group of cases he had described in 1893. Since that time he stated that he had met with no less than twenty-five cases of wasting of the intrinsic muscles of the hand presenting a similar symptomatology. He remarked that Farquhar Buzzard had demonstrated that the symptoms in these cases were to be attributed to an affection of the first dorsal nerve-root, and he proceeded to radiograph such of his cases as he could trace, with a result that a well-

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marked cervical rib was found to exist in ten out of fourteen patients examined. These X-ray examinations consequently afforded confirmatory evidence in support of Thorburn's contention that the cervical rib is an important factor in the causation of atrophy of the muscles of the hand; while Jones also made the observation that the cases of cervical rib in which a bony prominence can be felt with ease are usually free from any pressure symptoms so far as the brachial plexus is concerned. He makes no reference, however, to the etiology of those of his cases (four out of fourteen) in which no "well-marked" cervical rib existed.

Thus, while it has long been known that a cervical rib may, in certain cases, produce symptoms by pressure upon the brachial plexus, further observation has shown that similar symptoms are met with in cases in which no cervical rib is demonstrable. What, then, is the explanation of the symptoms in these cases? It is certainly possible, as has been suggested by Sir William Thorburn and others, that the rib may be situated at such an angle that the X-ray picture fails to demonstrate its presence? Again, the pressure symptoms may be due to the band described by Sir David Wallace³⁰ in the case to which we have referred, and especially emphasised by Percy Sargent,²⁰ who writes as follows:—"I have carefully observed this non-ossified portion of the rib. It is a dense fibrous cord imbedded in muscle, and attached above to the rudimentary bone, whilst below it is most commonly attached to the first dorsal rib behind the sulcus subclaviæ. The band has many times been observed to be tightened by inspiration, and also by traction upon the arm. I have demonstrated this fact several times by detaching the cervical rib completely from its vertebræ, and observing that it is pulled down away from its former level when an inspiration occurs." Keen¹⁴ reports a case seen by him in 1906, in which he came to the conclusion from the X-ray appearances that the symptoms present were caused by a partially developed first dorsal rib, and other cases of the same kind have since been reported. The same observer records a second case seen in the previous year of "supposed cervical rib, there being no pulse up to and including the axillary artery on both sides, and later none in the subclavian. The skiagraph showed no such rib." Further experience has shown that the first dorsal root or lower cord of the brachial plexus is sometimes pressed on by an abnormal or even by a normal first rib, and that pressure symptoms may be

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so produced, a suggestion tentatively mooted in the case which we described in 1903. The following case, which afforded suggestive evidence if it has not actually proved this contention, is also of interest, since, so far as we know, this was the first case in which the first dorsal rib was intentionally removed for the purpose of alleviating the symptoms of rib pressure.

CASE VI. *Unilateral Symptoms attributed to Rib Pressure. Rudimentary Cervical Ribs. A Portion of First Rib removed by Sir Harold Stiles (November 1911) with most Satisfactory Result.*—A masseuse, about 28 years of age, consulted one of us (E. B.) on 13th October 1911, upon the advice of Sir Harold Stiles. The patient stated that in September 1910 she had been operated upon for appendicitis, and that a day or two after this operation she began to be troubled with pain above the left clavicle, and down the inner side of the left forearm. She had also noticed weakness in the left hand about the same time. When we examined the patient there was very pronounced atrophy of the left abductor pollicis and some wasting of the opponens pollicis and interossei. Further, an area of sensory loss both to touch and pain (thermal sensibility was not examined) was detected along the inner surface of the arm, extending from 3 or 4 inches above the elbow to the wrist, while tenderness was complained of on pressure immediately above the clavicle in the neighbourhood of the spine on the left side. No cervical rib was palpable. An X-ray photograph, however, showed a bilateral rudimentary cervical rib. Pressure paralysis was diagnosed, but since it seemed very questionable whether the rudimentary ribs shown in the radiogram could be responsible for the symptoms, Sir Harold Stiles decided to remove a portion of the first rib. The piece of rib removed presented a normal appearance, and the operation was followed by complete relief from pain and gradual improvement in the motor paralysis.

Since then Stiles has carried out the same operation in several cases of rib pressure with most satisfactory results. We have personally observed several cases in which symptoms which we attributed to rib pressure were not associated with a demonstrable cervical rib. Proof that pressure symptoms may be caused by an apparently normal first dorsal rib is, as has been mentioned, afforded by the fact that in certain cases which have been operated upon, removal of the rib has resulted in the disappearance of symptoms. Objection might be taken to this conclusion on the grounds that in these cases the pressure is actually produced by the ligament which sometimes passes from the apex of the cervical rib to the first rib to which it is

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attached. If this is so, removal of that portion of the first rib, which includes the attachment of this ligamentous process, might be expected to relieve pressure just as readily as division of the band itself. On the other hand, in more than one case which we have observed, neither did the X-rays show any abnormality of the transverse processes of the seventh cervical vertebra, nor was any evidence of such a band found on operation. Individual cases of brachial compression neuritis, where the symptoms were attributed to pressure by a normal first rib, have been reported by Thorburn,²⁰ Murphy,¹⁷ and Morley.¹⁶ Stopford,²² in a recent paper (1919), states that in less than two years he has met with no less than ten cases of compression neuritis produced by a normal first rib, and Wheeler³¹ has also reported cases of the kind. *These observations demonstrate that pressure symptoms referred to the brachial plexus may be caused by a cervical rib, by a rudimentary first dorsal rib, or by a normal first dorsal rib.*

Developmental Antagonism in relation to Brachial Plexus and Rib Anomalies.

The anatomical observations of Wingate Todd²⁸ and Wood Jones¹³ are of much interest in relation to the etiology of cervical ribs and rib pressure. While the former holds that the rib anomalies under discussion are not attributable to a single cause but are "errors in segmentation or differences in the development of bony tissue which are associated with the presence of variation in the disposition of the nerves and vessels in this situation," the latter observer is of opinion that the existence of a cervical rib or the presence of a rudimentary first dorsal rib is largely determined by differences in the formation of the brachial plexus. Wood Jones has clearly demonstrated that the lower cord of the brachial plexus lies in and produces the sulcus subclaviæ, that the depth of this groove varies greatly in different individuals, that the contribution from the first thoracic nerve to the brachial plexus is subject to great variation, and that the depth of the sulcus subclaviæ varies as the contribution from the thoracic nerve increases. Again, this observer points out that the appearance of the normal costal element of the seventh cervical vertebra indicates that it is abbreviated by the corresponding nerve-root, while the elements above this level show increasing evidence of the downward straining of the nerves which form

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the brachial plexus and a proportionate diminishing costal element. These appearances, he argues, indicate that there is a constant antagonism between the developing nerve and the developing rib element, and that the presence of a cervical rib or of a rudimentary first dorsal rib is determined by differences in the formation of the brachial plexus. Thus he asserts that when a brachial plexus includes caudal nerve-roots which are normally outside the limits of the plexus, the interference with the development of the first rib may naturally be expected to reach its maximum. Consequently, in those cases in which the second thoracic nerve becomes added in whole or in part to the plexus, the first dorsal rib may closely resemble a developed cervical rib. In other words, Wood Jones arrives at the conclusion that the development of the ribs is determined by the nerve-roots, and that antagonism, dependent upon the formation of the plexus, whether pre-fixed or post-fixed, may play a prominent rôle in connection with the question of rib pressure. This view affords an explanation of the circumstance that a particularly well-developed cervical rib is seldom associated with pressure symptoms. Sargent,²⁰ who has described a specimen of a pre-fixed plexus in which there was no contribution from the first dorsal root and in which there was a cervical rib, states that rudimentary first dorsal ribs are not so common as accessory cervical ribs, and that in man the post-fixed plexus is not so common as the pre-fixed type; he remarks that these facts give support to Wood Jones' conclusions. On the other hand, Wingate Todd (quoted by Sargent) has shown from a detailed examination of four dissections that cervical ribs may occur with a normal brachial plexus, and consequently concludes that "the disposition of the nerve-trunks alone is insufficient in many cases to account for the presence and length of rudimentary ribs."

Factors which Determine Symptoms.

Pressure symptoms are only observed in a small proportion of individuals with cervical ribs. Borchardt² states that they occur in five to ten per cent. Consequently, while it must be admitted that variations in the formation of the brachial plexus may predispose to rib pressure, additional factors must be responsible for the determination of symptoms. In this relation *Sex* is evidently of the first importance. Although there is no evidence, so far as we know, to show that cervical

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ribs are more frequent in women than in men, the greater frequency with which symptoms of rib pressure are observed in the female as compared with the male sex is striking. Thus twenty of our twenty-three patients were women, an experience similar to that of other observers. Thorburn,²⁶ for instance, met with only two males in a series of 17 cases, while fourteen of Hinds Howell's sixteen patients were of the female sex. Hinds Howell¹⁰ suggests that the more thoracic type of respiration in the female may be a determining factor. Wingate Todd²⁷ has shown that in females a pronounced dropping of the shoulder girdle takes place in early adult life, and his suggestion that this may afford an explanation of the unequal affection of the sexes is an attractive one. The following case is of interest in relation to the effect of dropping of the shoulder girdle in determining symptoms of rib pressure:—

CASE VII. *Unilateral Symptoms of Rib Pressure developing after a Sling had been Discarded. No Cervical Rib.*—A young woman, 26 years of age, consulted one of us (E. B.) on the advice of the late Dr F. E. Batten. In September 1914 the patient ran a spike of wood into the palm of the left hand. The splinter was removed under gas three days later, but for some time the hand was very painful, and for several weeks after the injury she had worn a sling. Some six weeks or two months after the accident, the patient first complained of pain in the left arm which had been present more or less since that time. When examined in September 1915, the scar of the wound, which was situated on the radial aspect of the left index finger, was found to be very sensitive. In addition, an area of dissociated anæsthesia, which had been also observed by Dr Batten a month or two previously, was demonstrated along the ulnar side of the left forearm, while tenderness was complained of when pressure was applied to the left side of the neck in the region of the lowest cervical transverse process. There was no muscular wasting, and no pronounced weakness in the hand was detected, although it must be admitted that the sensitiveness of the scar made it difficult to be certain on this point. The pulses were equal. A cervical rib had been suspected by Dr Batten, but no rib had been seen in the radiogram. The symptoms must have been due to rib pressure in this case, and the conclusion appeared to be justified that they had been determined by the unaccustomed weight of the shoulder-girdle after the sling had been discarded.

The *Age* at which symptoms appear is of interest. Thus, in 20 of our cases in which this point is noted, the average

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age was 22, the youngest patient being 15, the oldest 38 at the time when symptoms were first noticed. Instances in which symptoms made their appearance at a much later date are, however, referred to in the literature; in childhood, symptoms of rib pressure are seldom if ever met with. *Occupation* in exceptional instances has evidently been related to the production of symptoms. Thus Sargent²⁰ met with three instances in seamstresses, two in clerks, and two in telegraphists, while one of our patients was qualifying as a professional pianist at the time the earliest manifestations were complained of. The symptoms were referred to the right arm in 14 of our cases, to the left in 10, while in 1 both upper extremities were affected. Sargent reports that of 24 cases operated on by him, in 5 the symptoms were bilateral; while he further remarks that among the 19 unilateral cases, the symptoms were on the side of the larger rib in only 8. *Posture*, and notably confinement to bed, is certainly a factor of importance. Thus, two of our patients first developed symptoms while in bed after an operation for appendicitis, one during an attack of influenza, one while ill with diphtheria, one after a confinement, one after sitting in a dentist's chair for a couple of hours, while two attributed their symptoms to carrying a young baby. The possibility of an associated infective factor in some of these cases (*e.g.*, influenza and diphtheria) has also to be considered. Patients suffering from symptoms due to a rib pressure often complain of pain in the affected arm while lying in bed. It seems probable that the pain is caused by falling back of the shoulder girdle. Debility, anæmia, loss of weight and general ill-health undoubtedly play a rôle in certain instances, while *trauma* has been the obvious determining cause in some. Thus among our cases the symptoms were attributed by individual patients to the following causes:—"a strain while playing golf," "a lurch of the motor car in which the patient was driving at the time," "a fall from a bicycle with injury to the shoulder," and "lifting heavy weights." Often, however, no history of an obvious determining factor can be obtained.

Symptomatology of Rib Pressure.

When a cervical rib is present and particularly well formed, it may give rise to a prominence in the neck. This may be unilateral or bilateral. Attention may be arrested by the

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pulsation of the subclavian artery, an inch and a half or so above the clavicle, for the artery passes over the rib when the latter is well-developed. The artery, as in Keen's case,¹⁴ may actually be dilated beyond the point at which it crosses the rib, a fact which is difficult to explain. Aneurism may be simulated. A systolic murmur is sometimes to be heard over the artery external to the rib, and in rare cases a thrill may be palpable. Even when a cervical rib cannot be detected with certainty, the lower part of the neck may appear to be unduly broad. Pain in the neck is exceptionally complained of; it was noted by Thorburn²⁶ in 3 of 13 cases. This symptom may occur in association with certain movements of the upper limb or upon deep inspiration, as in one of our patients. Tenderness in the neck, accompanied sometimes by a sensation of "pins and needles" in the arm and hand, when moderate pressure is applied in the region of the transverse process of the seventh cervical vertebra, is, in our experience, usually present even in cases in which no cervical rib can be demonstrated by the X-rays.

The nervous symptoms due to rib pressure are commonly referred to the first dorsal root, the eighth cervical root, or the lowest cord of the brachial plexus. Exceptionally, however, symptoms referable to a higher level have been observed. Déjérine,⁷ for instance, has reported a case in which sensory loss in the distribution of the fifth and sixth cervical roots was associated with a cervical rib, and in which the removal of the rib was followed by disappearance of the symptoms. Although cervical ribs are bilateral in about 70 per cent. of the cases in which they occur (Hinds Howell),¹⁰ pressure symptoms are, as a rule, unilateral. Thus among our 23 cases, in only one were the symptoms bilateral, an experience which, however, probably exaggerates the relative frequency of unilateral cases. Pressure symptoms when associated with bilateral ribs are, as has been mentioned, frequently confined to, or are more pronounced upon, the side on which the rib is less well-developed, while, as Lewis Jones noted, it is exceptional to meet with symptoms when the rib is unusually prominent. *Pain* is the symptom for which advice is most often sought; it was a striking feature in fourteen of our cases. Exceptionally, this symptom is only complained of in the early history of the case; as a rule, however, it tends to persist though it may be intermittent. The pain varies greatly in character in different cases; it is

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often described as shooting, sometimes as aching or burning, and it is usually referred to the inner side of the forearm. As Farquhar Buzzard remarks, however, it may be of almost any description or distribution. *Subjective sensations*, such as tingling, numbness, and "pins and needles" in the finger-tips, and particularly a feeling of coldness in the hand are of frequent occurrence and are sometimes observed in cases in which pain is not complained of. No *objective sensory* disturbance may be detected although very usually some sensory loss, which corresponds more or less to a root distribution, is met with; and it is as a rule of a dissociated character, tactile sensibility being less affected than painful and thermal sensibility. The sensory impairment when present is most commonly situated along the inner side of the forearm, while the little and ring fingers are usually involved; in rare cases the anæsthesia is limited to the hand. Although sensory symptoms may be alone complained of in many cases, *motor symptoms* are also observed, while exceptionally the patient complains of motor weakness only. This may amount merely to a very slight paresis, while in other cases there is pronounced loss of power and wasting. Certain of the intrinsic muscles of the hand are affected, notably the abductor and opponens pollicis, while, as Kinnier Wilson³² remarks, the flexor brevis, which is also supplied by the median, escapes. In other words, the muscular atrophy is selective in distribution as opposed to the global or generalised atrophy met with in progressive muscular atrophy, etc. Wilson distinguishes a median and an ulnar type of atrophy; in the first type the abductor and opponens pollicis are involved, while, in the second, there is wasting of the interossei and an approximation to the *main en griffe*. Both groups of muscles may be affected. When the atrophy is pronounced, the appearance of the hand, especially the wasting of the abductor pollicis, is very characteristic. The flexors of the fingers were also involved in two or three of our cases. Clonic movements of the hand, which have been occasionally recorded, were described by one patient whom we examined. *Vasomotor changes*, blueness and coldness of the hand and fingers, with it may be trophic changes in the nails, are met with in a small proportion of cases. As Wingate Todd suggests, the vasomotor symptoms are probably due to pressure on the first dorsal root, which carries a large proportion of the sympathetic fibres to the upper

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limb, and not to direct interference with the blood supply. *Acroparæsthesia* with pain confined to the hand and fingers has been observed in association with cervical ribs by Farquhar Buzzard,⁵ who refers to "cases, generally in middle-aged women, who complained that soon after going to bed they woke up with intense burning pain in the hands and fingers. This was relieved to some extent by keeping the hands outside the bed-clothes, but disturbed nights often resulted. When they got up in the morning their hands felt useless and clumsy, but after a time this would improve and the patient be able to carry on her work throughout the day. The pain and discomfort would return again at night. In several cases of that kind there were distinct cervical ribs, and in one such case Mr Sargent had operated and given the patient relief." The *radial pulse* in some cases of rib pressure is less forcible or absent on the affected side, yet when the arm is raised to the horizontal the difference between the two pulses may be no longer obvious. Thrombosis of the subclavian artery has been reported in several instances, and cases have been recorded in which gangrene of the fingers was observed. Œdema of the arm is of very rare occurrence; this is, no doubt, to be explained by the fact that the vein lies in front of the scalenus anticus muscle, and is consequently not exposed to pressure.

In a small proportion of cases in which the symptoms above described are observed a cervical rib is recognisable in the neck by the ordinary methods of examination; while in other cases which present a similar symptomatology the presence of a rib is only demonstrable by means of X-rays. Again, in some cases characterised by identical symptoms the X-ray examination reveals a rudimentary first dorsal rib, while in other instances no abnormality of the ribs can be detected. Proof that the symptoms in the cases last mentioned are dependent upon rib pressure is, as Sir Harold Stiles has repeatedly demonstrated, afforded by the fact that removal of the first dorsal rib is immediately followed by improvement, and ultimately, as a rule, by complete and permanent relief.

Diagnosis.

Brachial plexus lesions due to rib pressure may be conveniently classed, from the point of view of diagnosis, into two

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groups, viz. :—(1) Cases in which symptoms referable to the first dorsal root or lower cord of the brachial plexus are evidently caused by rib pressure, and in which a cervical rib or a rudimentary first dorsal rib can be demonstrated, and (2) cases in which the same group of symptoms is unaccompanied by any evidence of a rib anomaly, the symptoms being due to pressure by a normal first dorsal rib.

Again, a variety of types may be distinguished :—(a) Cases characterised by sensory, motor, and it may be vasomotor symptoms; (b) Cases in which pain and other subjective sensory phenomena are alone complained of, there being no objective sensory or motor disturbance; (c) Cases characterised by muscular weakness and wasting, pain and other sensory phenomena being either absent or inconspicuous features; (d) Rare cases in which vasomotor disturbance is the striking morbid manifestation; (e) Cases in which acroparæsthesia and pain in the hand and fingers are associated with and apparently produced by rib pressure (Farquhar Buzzard).

A diagnosis may be difficult in cases in which there is no pronounced atrophy or sensory loss. The occurrence of pains from time to time in one or it may be both upper extremities, particularly in a young woman, should always suggest the possibility of rib pressure. When on further inquiry it is ascertained that the pain is confined to the forearm and that it is accompanied by other subjective symptoms, such as coldness in the hand, numbness or tingling in the finger-tips, and "pins and needles," referred especially to the little and ring fingers, possibly too by a feeling of weakness or clumsiness in the hand, the strong probabilities are that the symptoms are attributable to this cause. Corroborative evidence in support of the diagnosis is afforded when a history is obtained to the effect that the pain is relieved by raising the arm above the head, when there is localised tenderness in the neck, and when there is a difference between the radial pulses on the two sides. In a certain proportion of cases, the demonstration of a cervical or rudimentary first dorsal rib by the X-rays affords practically conclusive proof as to the nature of the condition. *It is to be remembered, however, that a diagnosis can and must in many cases be arrived at from the character of the pressure symptoms, for corroborative evidence is by no means always afforded by the X-ray examination.*

Certain problems in differential diagnosis occasionally arise.

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An *ulnar* and even a *median neuritis* may be simulated by rib pressure. We have recently examined two cases, in both of which the question arose whether the symptoms had been caused by a fracture of many years' duration in the region of the elbow. One of these patients was proved by an X-ray examination to have a cervical rib to which the symptoms were undoubtedly attributable, while in the second case, which was under the care of Sir Harold Stiles and in which the distribution of the symptoms was that of an ulnar paralysis, rib pressure was evidently the determining cause. The facts of this case are as follows:—

CASE VIII. *Symptoms of Rib Pressure associated with a Motor and Sensory Distribution corresponding to that of the Ulnar Nerve. Old Injury to the Elbow; ? Ulnar Type of Rib Pressure or Rib Pressure acting in conjunction with Injury to Ulnar Nerve, the former determining the Onset, the latter the Distribution, of the Symptoms.*—A married woman, 27 years of age, who was referred to us by Sir Harold Stiles, and who complained of pain in the right forearm and weakness of the right hand, informed us that since her fourth year, when she had sustained a fracture of the arm, she had been troubled with pain about the right elbow. Five months prior to our examination the patient had had a child, and she stated that she had first noticed pain down the front of the right forearm, which extended into the little and ring finger, a few days after her confinement. She had also noticed that since that time, and not before, her hand had been weak, and that about the same time the muscles of the hand had begun to waste. The pain was said to be sharp in character, and the patient had experienced at times a sensation in the little and ring fingers "as if they were bursting." When the pain, which she attributed to carrying her baby on the right arm, was severe, the patient had found that it was relieved if she raised the arm above her head. Upon examination the appearance of the hand was similar to that observed in cases of ulnar paralysis. The little and ring fingers were slightly flexed, while the adductor pollicis and interossei were wasted. There was no weakness of the opponens pollicis, abductor pollicis, flexor carpi ulnaris or flexor profundus digitorum. Partial sensory loss corresponding precisely in distribution to that of the ulnar nerve was present on both the front and back of the hand. Local tenderness and "pins and needles" passing into the little and ring fingers were complained of on pressure in the neck. No rib was demonstrated on X-ray examination, nor was there any difference between the radial pulses. At first sight the case appeared to be one of ulnar neuritis determined

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by the old injury to the elbow. On the other hand, the facts that the symptoms were first experienced a few days after her confinement, that the pain extended from the elbow downwards, that the pain was relieved when the patient elevated the arm, that there was localised tenderness in the neck, and that "pins and needles" were complained of in the little and ring fingers when moderate pressure was applied in this situation, clearly proved that the symptoms were due to rib pressure. They had no doubt been determined by carrying her child on her right arm when she, the patient, was in a poor state of health. Whether this case should be included under the ulnar type of rib pressure or whether the old injury in the region of the ulnar nerve had played a rôle in determining the distribution of the symptoms, it is difficult to say.

Another patient examined by us who had also had an old injury in the region of the elbow, which might well have involved the ulnar nerve, presented symptoms which we were at first inclined to attribute to rib pressure. An X-ray examination, however, demonstrated the presence of calcareous glands in the neck but no cervical rib. At the time this patient was first seen no superficial glands were definitely palpable, but when she was examined some months later the glands had attained a considerable size. Professor Alexis Thomson operated upon this patient and removed the glands, with a result that the pain in the arm was relieved while the localised weakness and wasting in the hand were found to have very much improved when she was last seen. *Progressive muscular atrophy*, a diagnosis which we have known advanced on more than one occasion, may be simulated by the wasting due to rib pressure; this is notably so when in cases of the latter kind pain and objective sensory disturbance are inconspicuous or absent, and especially when the symptoms are bilateral. The selective distribution of the atrophy in the cases under consideration, the absence of fibrillary tremors, and the fact that the wasting remains localised, are points which should enable the observer to exclude progressive muscular atrophy with certainty. *Syringomyelia* may present a picture which resembles that produced by rib pressure, for in this disease muscular atrophy, when present, is not infrequently confined to the small muscles of the hand, vasomotor disturbances and scoliosis are often met with, and dissociated anæsthesia is a characteristic feature of the affection. The resemblance, however, is only superficial, and a study of the distribution of the sensory loss and of the muscular atrophy should at once place the

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diagnosis beyond doubt. Nystagmus and oculo-pupillary symptoms, which are often met with in syringomyelia, are not observed as a result of rib pressure. It is true that in more than one instance of cervical rib recorded in the literature oculo-pupillary symptoms are stated to have been present, but it seems highly probable that these patients may have been suffering from syringomyelia. Cases have, indeed, been reported by Borchardt,² Oppenheim,¹⁸ and Marburg,¹⁵ in which cervical ribs occurred in association with syringomyelia, a fact which is not surprising, for in the latter disease congenital stigmata are very frequent. Needless to say, when pain and other symptoms referable to spinal nerve-roots are complained of, the possibility of a meningeal or vertebral tumour is to be kept in view, and evidence of interference with conduction in the spinal cord (*e.g.*, Babinski's sign) looked for. A *functional paralysis* of the upper limb was observed in a case seen by one of us in which the facts suggested associated rib pressure. That the pain met with in cases of rib pressure might well determine the localisation of hysterical symptoms can be readily understood. In still another case in which pain in the arm, which at first suggested rib pressure, was complained of, the evidence indicated that the pain was largely of psychic origin. It has been suggested that *occupation neuroses* may exceptionally be determined by the presence of a cervical rib, and in one case, a man with writer's cramp, the patient also manifested signs which suggested, though they were not actually proved to be due to, rib pressure on the affected side. From these remarks it will be seen that a diagnosis of rib pressure is by no means always an easy problem.

The technique of the X-ray examination in the diagnosis of rib pressure calls for passing comment. Thus Wood Jones insists that it is often impossible to say whether an abnormal rib is really a cervical rib or a rudimentary first dorsal rib unless the vertebræ can be counted from the atlas downwards. In this connection, too, we would hazard the suggestion that these photographs might be taken always at a constant or (?) appropriate angle, for it would appear to us to be possible that reports met with occasionally in the literature to the effect that there is overcrowding of the ribs may, in some instances, be explained by the angle at which the photograph has been taken.

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Indications for, and Results of, Operation.

Cases of rib pressure in which the symptoms are not pronounced may sometimes be materially benefited by attention to the general health, and do not call for surgical treatment. When pain occurring from time to time is alone complained of, this symptom can usually be relieved by a sling which supports the elbow, while a blister above the clavicle may be helpful. Stopford lays stress upon the development of the trapezius muscle by exercise and faradic stimulation, with the object of counteracting the dropping of the shoulder-girdle. When pain due to rib pressure is so severe as to cause constant annoyance, or when pain or muscular weakness, or both, are producing such inconvenience as to interfere with the patient's occupation, surgical intervention is indicated.

The results of operative treatment in those cases in which pain is the prominent symptom are most satisfactory, for the pain is usually completely relieved. Thus, of 15 cases reported by Thorburn,²⁰ in all of which pain was present, this symptom was completely cured in 12 and relieved in 3. Again, Sargent,²⁰ whose experience has probably been unique in this department of surgery, reports that in all of the 5 cases he had met with in which there was bilateral pain, the patient returned to him at a later date and asked to have the opposite side operated upon. Paralysis, which was present in 12 of Thorburn's 20 cases, was completely cured in 5 and greatly relieved in 5, while 2 cases were not traced. When there is pronounced wasting of the hand muscles, complete recovery cannot be expected. Ill-effects occasionally result from surgical intervention. Thus the pleura may be opened, while the suprascapular nerve or the nerve to the serratus magnus or trapezius may be injured. Again, if the superficial branches of the third and fourth cervical nerves are divided, the patient may, for long afterwards, suffer from intense pain in the region of and below the clavicle. Further, the brachial plexus may be injured in the course of the operation as in two cases referred to by Sargent, in both of which there was complete paralysis of the upper limb, which was probably due to bruising of the plexus. In neither case was recovery complete six months after the operation. Finally, it would seem that although unfortunate sequelæ such as those above-mentioned may very occasionally

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occur, the risks of operation, in the hands of an experienced surgeon, are now comparatively small, while the results of operative treatment are often brilliant.

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Mr D. M. Greig, F.R.C.S., the Curator of the Museum of the Royal College of Surgeons of Edinburgh, demonstrated at the Meeting at which this paper was read a number of specimens of cervical rib from the College Museum.

"CARDIOSPASM," CONGENITAL NARROWING OF THE ŒSOPHAGUS AND ŒSOPHAGECTASIA.

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(Continued from page 21.)

III. ŒSOPHAGECTASIA.

In alleged association with spasmodic contraction, in supposed sequence to congenital narrowing of the Œsophagus, Œsophagectasia demands consideration. Dilatation of the Œsophagus, though well known from a considerable number of pathological specimens previous to the days of radiography, has come into more prominence since the opaque meal rendered the condition easily recognisable. Its existence is not incompatible with long life, yet apparently may be the cause of early death; but death from Œsophagectasia in infants and young people is certainly very rare. That the condition may be congenital is certain, and if the affection be to a severe degree, may bring about fatal malnutrition; but the dilatation is found more particularly after middle life, and often does not give serious trouble till old age. The following is a typical example of Œsophagectasia :—

CASE VII.—In September 1918 I was asked by Professor A. M. Stalker in the Dundee Royal Infirmary to see Mrs Jessie D., aged 57, who had been admitted to his wards complaining of "vomiting off and on during twenty years." Born and bred in the neighbouring country district, she was intelligent and had retained a good memory. Her father died, aged 34, of some "spinal trouble," probably tuberculous, and her mother died, aged 71 years, of "bronchitis," to which she had long been subject. Her four sisters died in infancy. She had had three sons and two daughters who were well, their ages ranging from 39 to 26, and one child dead of "natural causes."

She is emphatic that she has had no previous illness, never any indigestion, never any pain after food, never any hæmatemesis nor diarrhoea. About twenty years ago she began to vomit her food on occasions. This was not associated with any nausea nor with pain. If the food returned it did so immediately, but only after solid food, and she gave no description suggestive of evacuation of the entire gastric content. Later, these attacks of "vomiting" would continue during one or two weeks, and then she would have an interval with no

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vomiting; but she had modified her diet to suit her circumstances and always preferred fluid, semi-solid and soft food. She had had even more trouble during the three years which preceded her admission, and during that period even liquids were occasionally returned. She attributed the condition to the onset of the menopause, that unailing excuse the sex find for the inexplicable. Ten years ago she had an attack of bronchitis, and had been troubled with its hyemal recurrence since. Two months before admission she had been confined to bed with a suppurating prepatellar bursitis, and during that period her comparative recumbency had aggravated the condition until inability to swallow any food supervened. She had lost much weight and become very weak, and looked much older than her years. On the day of admission she vomited all liquids immediately or within a few minutes of swallowing. She could only attempt to swallow if well propped up in bed. Accurate observation on the following day proved that though she vomited every time she swallowed, all the liquid was not returned. The radiographer's report was "stricture of œsophagus at diaphragm complete; œsophagus hugely dilated from top to bottom." Within eight days she was swallowing food much better and the vomiting seemed to be most liable to come on in the mornings. Her residence in hospital, prolonged for a few weeks, resulted in great improvement of her general condition and a return to her previous degree of dysphagia. This improvement is still maintained (June 1921), and she is convinced that she has no difficulty in swallowing but that her stomach troubles her.

In the case of this patient the points to be noted are: the late onset, the progressive dysphagia, the complete inability to swallow unless the swallowing be assisted by gravitation, and the fusiform dilatation of the œsophagus as shown by radioscopy. There is no history of preceding pain during deglutition, none of peptic ulcer of the stomach. There has been no evidence of "spasm," and congenital narrowing is out of the question because the history of the lifelong recurrence of dysphagia is wanting, and one is driven to the conclusion that the œsophageal walls have yielded because of increasing debility of the muscular fibres, or because of their enervation. A previous case which came under my notice in 1912 supplements and confirms many of the symptoms.

CASE VIII.—William K., a yarn-dresser, aged 57, had just finished breakfast one day in September 1911 when part of the meal suddenly regurgitated. It was not vomiting as it was not associated with effort or nausea; he had no pain and neither blood nor mucus was noticed in the ejected food. No further trouble of this kind nor any difficulty in swallowing occurred during the subsequent

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two months, but after that regurgitation became increasingly frequent. He learned by experience that if he ingested solids they would be immediately returned. The regurgitation was more apt to take place after breakfast than after dinner, and he seldom “vomited” after supper, though the food was much the same as he had at breakfast.* The food appeared to him to be arrested about the level of the manubrium sterni. Sometimes even a drink of water was immediately returned. About three days out of seven he had no regurgitation and was able to “swallow anything,” though it must be noted that he failed to appreciate his now invariable carefulness. Early in 1912 he began to lose weight. A radiogram showed some dilatation of the œsophagus throughout its entire length. The passage of the largest size of œsophageal bougie presented no difficulty and was not followed by either pain or bleeding. Considerable improvement in swallowing resulted, however, and as he gained in weight and strength his dysphagia lessened. During the fortnight he was in hospital his weight increased by 8 lb. By 1914 his weight had further increased by 4 lb. and he felt well and strong. He had adapted himself to circumstances, and though he maintained that he could swallow “very nearly as well as ever” he had to avoid solids, be careful in swallowing, and to take his food “very slowly.”

This case emphasises two additional points, namely, that the greater the œsophageal dilatation the more difficulty there is in “hitting” the lower opening with a bougie, and that the successful passage of a bougie is often followed by temporary and even prolonged improvement in swallowing. The first observation explains the difficulty often experienced in passing a soft rubber tube, a difficulty which disappears when a more resistant bougie or tube be used. The second observation is well known and has been used as an argument in favour of the existence of “cardiospasm,” and has even led to the coining of the term “achalasia,”²² a term, unfortunately, which has added an additional complication to an already much confused subject. The temporary improvement which follows dilatation is, to my mind, analogous to that freedom from recurrent strangulation which follows manipulation of the orifice in a congenital diaphragmatic hernia, as I have recorded elsewhere.²³ The analogy is the more striking in that it is the diaphragm which limits the size of the opening in each case.

* This symptom seems to be frequently present and apparently depends on the enervated muscular fibres, having lost tone during sleep and disuse, regaining their tone to some extent during the hours when consciousness may supplement effort.

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It ought to be easy to conjecture what would take place were an obstruction to occur at the cardia, while the musculature and innervation of the œsophagus remained unimpaired; but whether "conjectures" would be accepted by those who had already formulated views on œsophagectasis is another matter. Fortunately I am able to present incontrovertible evidence in the following case:—

CASE IX.—An unmarried lady, 48 years of age, after some preliminary indigestion, was seized with severe pain at meals, inability to eat on account of the pain, and rapid loss of flesh. An able consultant agreed with her medical attendant that she was the subject of cancer of the stomach. Gradually the pronouncement was falsified for the pain disappeared and the indigestion ceased. Moreover, she found she was able to swallow liquids and semi-solid matter freely, but her ability to swallow solid food never returned. In fact she had had a gastric ulcer at the cardia, which, when it healed, had brought about a permanent cicatricial contraction of the œsophageal exit. She was 73 years of age when I saw her, the gastric disturbance having occurred twenty-five years previously. She was spare of body but in good health, and all her functions were normal *except* that she was not able to swallow solid food. As the intrinsic structure of the œsophageal tube had never been affected, its musculature never interfered with, but only its exit diminished by a cicatrix, here, if anywhere, one would have expected to find a cephalic dilatation. The radiogram, however, shows that the œsophagus, a muscular tube more or less fixed at both ends, had retained its normal calibre, but, in its efforts to overcome the obstruction, had hypertrophied, become tortuous and approximated an "S" in shape. The upper half of the œsophagus had passed to the left of the spine forming a dextro-concavity, the lower half had passed to the right of the spine forming a dextro-convexity.

Nothing, than the organ *in situ* post-mortem, could be more convincing that chronic obstruction to the escape of food calling for recurrent effort in a *normal* œsophagus, is *not* followed by dilatation, even during a quarter of a century. The œsophagus reacts as other tissues. Asked for increased effort it answers by calling up Nature's reserve of power, and hypertrophy results, while its channel becomes tortuous as other passages would do under similar circumstances.

From America where the home manufacture of soap renders the swallowing of "lye" (caustic soda) a common accident to children, come many reports of traumatic stricture or narrowing of the œsophagus.²⁴ Should the child survive, proximal dilatation generally results. Kahler²¹ and Guisez²⁵ point out

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that months or years may elapse between the traumatism from the escharotic and the appearance of the consequent stenosis. During this latent period there is probably a proximal hypertrophy of the œsophageal muscle, enabling it to cope with the inaction of the injured area. As the stenosis increases the hypertrophy proves insufficient, the compensation breaks down, and dilatation occurs. Should the injury be extremely severe there may be no stage of hypertrophy. Thus Mackenzie²⁶ records the case of a child of $2\frac{1}{2}$ years who died six months after swallowing an escharotic, the nature of which is not stated. The stenosis was 3 inches below the cricoid level, the œsophageal lumen was reduced to 1 mm., and there was proximal dilatation of the œsophagus which was “not markedly reduced in thickness.”

Parkes Weber,²⁷ erroneously I think, attributes a fusiform dilatation to spasmodic stricture of the œsophagus in a case which so resembles my Case VII. that it justifies some detailed reference. The patient was a male, 80 years of age at death, who for ten years had been increasingly troubled with dysphagia. Eight years before death the dysphagia was so severe that a gastrostomy was performed, and the patient improved so much that the gastrostomy opening was allowed to close. The dysphagia returned, and two years later he was fed through a hard œsophageal tube as the lower opening could not be “traversed” by a soft tube. On post-mortem examination “the cardia, which did not appear much (if at all) thickened, admitted the passage of the middle finger; yet the stomach was empty, and the œsophagus contained food.” Could any demonstration be more conclusive that weakness of the œsophageal muscle was the reason why food in the œsophagus had not been propelled through a lower opening which permitted the passage of the middle finger, and presented no sign of overgrowth or contraction? The dilated œsophagus was examined by S. G. Shattock, who found that the œsophagus at the middle of the fusiform dilatation presented “a perfectly sound structure,” and “as to the cardia, the muscularis is quite normal, and there is no fibrosis of the mucosa.” There is no dubiety in the pathological report. Yet Weber concludes that spasm at the cardia, a spasm which has left no trace after death, has been so complete, so severe, and so prolonged, that the efforts of the œsophageal wall have become replaced by exhaustion, and dilatation of the œsophageal tube has followed.

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It may be contended that in malignant disease the malignant or inflammatory infiltration of the tube proximal to the stricture militates against dilatation, or that in the case of malignant growths there is not time for the production of œsophagectasia. That may be so in malignant growths, but in the case of non-malignant tumours there is plenty of time for distension, yet it is exceptional to find any.

I have shown in section II. of this paper that the so-called "membranous obstruction" of the œsophagus is not accompanied by dilatation, and perhaps the case quoted from an Italian source by Morell Mackenzie¹⁷ may test this rule. The name of the author is not stated, but the case was that of an old woman who had had dysphagia from early infancy. After death, a dilatation of the gullet was found, and "six fingers' breadth below the pharynx there was a completely circular valve with an opening one centimetre in diameter. This valve seemed formed by the folding inwards transversely of the mucous membrane involving the whole circumference of the tube, the free edge of the valve being strengthened by firm tendinous fibres running round it." The obvious criticism is of course that here there may not be cause and effect. There is no reason why a paralytic affection of the œsophageal muscle should not occur in an œsophagus, the seat of congenital narrowing, but the fact remains that the combination must be of extraordinary rarity. This lack of reliable reports again may be altered when congenital narrowing of the œsophagus gains the recognition it deserves.

Shaw and Woo²³ note that in some of their cases obstruction at the cardia seemed complete and that the œsophagus, distended by a barium meal, showed as a fusiform shadow. As such it remained until coughing or straining of the lungs brought about increased mediastinal pressure, when at once, a fine barium stream was seen to trickle through into the stomach. One may pertinently ask, is that the action of a healthy œsophageal muscle? Rather, indeed, is it evidence that the œsophageal muscle must be incapable of propelling the pultaceous mass through its lower opening, because the œsophageal exit presents so little obstruction that the mere pressure of the lungs in coughing, causes the œsophageal contents to pass on. Surely if this be the case the "obstruction" is negligible while the œsophageal weakness is all-important.

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Why, it may be asked, does not the phreno-cardiac segment of the œsophagus participate in the ectasia? It is surely because the diameter of the phreno-cardiac segment does not depend on the œsophageal muscle and its innervation, but is limited by the opening in the diaphragm through which the œsophagus passes. Could the phreno-cardiac segment participate in the ectasia, gravity alone would empty the œsophagus in the erect position. As it is, in these affections, gravity materially assists. The opening in the diaphragm being unaffected in œsophagectasia, it only becomes an obstruction because it is so small relatively to the dilatation of the œsophagus, and on account of the weakness of the dilated muscles the bolus of food cannot be propelled in the proper axis.

Years ago, Rolleston,²⁹ in reporting a case of dilatation of the œsophagus with hypertrophy, in a boy of 8 years, which followed an attack of whooping-cough, suggested as a cause “inhibition or atony of the longitudinal coat” rather than “a similar change in the whole musculature of the œsophagus.” At either end in this child the œsophagus was normal.

In quite a recent contribution Brown Kelly³⁰ relates interesting details. His patient, a lad of 21, had increasing dysphagia during six years. No further personal or family history is given. The patient survived his admission to hospital only eighteen days. He had learned that he could swallow better if he were standing up, and he could help the action “by stretching and contorting” himself. In other words, he took full advantage of gravitation, and assisted the useless œsophageal muscle by holding his breath, twisting himself about, and so increasing his intra-thoracic pressure. On post-mortem examination the œsophagus was found dilated throughout its entire length, and Professor Shattock who examined it, reported: “The muscular wall of the whole of the intra-thoracic length of the œsophagus is hypertrophied, *the overgrowth being limited, or almost so, to the circular fasciculi.*”^{*} Here is a perfect confirmation of Rolleston’s theory. “On removing the œsophagus,” writes Kelly, “it was held up and filled with water, but none escaped at the lower end. After a catheter had been passed, water ran through, but an hour later the cardia was again impermeable to water.” It

^{*} The italics are mine.—D. M. G.

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seems to be impossible to suggest a more convincing proof that the obstruction was mechanical and brought about by the altered relationship between the dilated œsophageal tube and its lower opening as controlled by the unaffected diaphragm. But there is another point which requires mention in this case. Professor Shattock adds: "The overgrowth is little marked, if indeed any is present, in the narrow segment which passes through the diaphragm. Below the diaphragm, the muscle becomes again thickened and attains a maximum of 4.5 mm. After a distance of 3 cm. (1 inch) the thickened muscle (the arrangement of which shows that it consists of circular fasciculi) shades off into the general muscular wall of the stomach. This sub-diaphragmatic thickening corresponds precisely in position with the cardiac sphincter."

This condition of dilatation of the œsophagus, it seems to me, could never have been brought about had the longitudinal muscular coat retained its functional activity, and both these eminent men, obsessed with ideas of cardio-spasm and hypertrophy, fail to see that the primary lesion is paralysis of the longitudinal coat, and that the circular coat endeavouring, but without success, to take on the lost function, has become hypertrophied, and, as one would expect if the lowest circular fibres of the œsophagus participated, those gastric muscular fibres close to the diaphragm would also undergo compensatory overgrowth. Hypertrophy cannot be said to be the rule, yet it is quite common, but it is rare to have the circular fibres affected throughout.

Hill³¹ inclines to the view that dilatation of the œsophagus where there is no anatomical stenosis, may be determined by want of relaxation of the diaphragmatic crura which encircle the œsophageal opening in the diaphragm, in fact a phrenospasm not a cardiospasm. Hurst²² acquiescing in a "cardiac sphincter" sees an inability of the exit to dilate, and Kelly and Shattock suggest the "sub-diaphragmatic thickening." Obstruction seems paramount in the minds of those who have considered the subject. Rolleston alone almost, has grasped the idea that the difficulty lies not in increased *obstructio a fronte* but in diminished *vis a tergo*.

The internal or circular muscular layer of the œsophagus is at best patchy. It is irregular in distribution as it is in thickness, and never develops the uniformity of the longitudinal

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coat. Whether the lower fifth of the longitudinal coat, being of unstriped muscular fibres, is more liable to nerve paralysis than the rest, cannot be asserted; though there seems some justification for believing that the lower part is more commonly where œsophagectasia begins, but this, or merely the anatomical peculiarity of the circular coat explains its irregular compensatory hypertrophy. That which the anatomist has failed to demonstrate, which the general surgeon knows not to be present, and which has no counterpart in other mammalia—the so-called “cardiac sphincter”—is called into being to explain “clinical evidence,” as if such “evidence” could exist without anatomical, physiological, and pathological support. Doubtless the stomach carries on digestion in such a way as not to facilitate regurgitation of food, but there is no true cardiac sphincter to ensure this. No wonder, then, that a current number of a medical journal,³² in a paragraph on “Dilatation of the Œsophagus without Stenosis,” sounds a note of disappointment that “a full-dress debate” of laryngologists failed to come to conclusions as to the ætiology.

Rolleston's suggestion that in the case he reported the nervous affection might be the result of whooping-cough seems not at all unlikely. Thomson³³ states that peripheral neuritis may follow influenza, measles, whooping-cough, and enteric fever, and is often characterised by a degree of motor paralysis; whilst Still³⁴ cites as presumptive evidence of the infective nature of infantile paralysis, the fact that he had observed paralysis occur in measles, scarlet fever, whooping-cough, and, in one case, eight days after vaccination. In none of these cases was the affection of the œsophagus, but if other muscles are liable, why should the œsophagus be exempt? Saundby³⁵ reports a case of syphilitic paralysis of the œsophagus, and quotes a similar case recorded by F. W. Mott. Local muscular paralysis from nerve affection commonly follows pharyngeal or laryngeal diphtheria, and cases of œsophageal affection with diphtheritic growth are by no means uncommon. Remote paralysis from diphtheria are well known to occur. Why in either case should the œsophagus always escape? The inability to swallow, of which I have personal knowledge, during diphtheria may quite well be an œsophageal involvement of nerves, and life is maintained by nasal feeding until the toxic affection passes off. Is it impossible that such an affection of the longitudinal muscular coat of the œsophagus should remain permanently?

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These affections though most common in, are not limited to, children, but quite a number of cases of œsophagectasia have begun in childhood though they may not be definitely recognised till long after the initial illness.

Be that as it may, the peristaltic action of the œsophagus is interfered with. It is more likely to be a progressive than a sudden deprivation of function which would be incompatible with life. As the neuro-muscular affection spreads, the œsophagus becomes increasingly involved. All this time the entrance and exit to the œsophagus remain unaltered. At the entrance there is no difficulty because the pharyngeal muscles grasp the bolus and the food enters normally ; but once in the œsophagus, the weakened œsophageal muscle fails to provide the *vis a tergo* which is necessary to propel the food along the tube, and the exit from the œsophagus, retaining its anatomical calibre, the normal cardinal orifice proves obstructive.

Apologia.—The rôle of an iconoclast is uncongenial, but criticism cannot be less acceptable to quondam worshippers because it is accompanied by reconstruction and simplification. Only the collation of worthily expressed ideas, could have permitted that generalisation which I have attempted, in relation to "cardiospasm," congenital narrowing of the œsophagus, and œsophagectasia."

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PRIDE OF BLOOD.*

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SINCE it is sometimes well to give a touch of formality to the most *impromptu* of occasions, I wish to dignify this extemporaneous talk by a title; I wish to speak to a text, namely, Pride of Blood.

In 1492 Christopher Columbus—an uncommonly courageous common man—broke completely with the tradition of his time, and as a consequence discovered a new world. Later he was followed on his perilous journey by a host of others—mostly at first by the forefathers of you and me—who acted in strict accordance with their tradition of being free at all costs. Shortly tradition again reached forth its restraining hand and seemingly limited freedom to an unbearable degree. The result was another breaking out of bounds and the beginning of a new country—of truly imperial proportions.

From this country to-day there travel two physicians, reaching, with comparative ease and luxury, in a few days, the home of their forefathers. And here we stand in a place which to us above all else signifies tradition. We come from a spot universally known to us as "God's Country." We come to breathe here an atmosphere which is, in unusual degree, permeated with the same beneficent elements.

That we are here in the way we are is possible because our common forefathers, following tradition, refused to be bound by it, and succeeded in creating a situation in which for a long time action has taken precedence. Of these two fundamental forces, beautiful, stabilising tradition and energetic, forward moving action, who shall say which is the more desirable? As inevitably and completely complementary as male and female, we may prefer the one to the other, but can make no distinction of importance. Action constantly recreates tradition and tradition directs action, guiding it in safe and useful lines; nor are the two ever wholly divorced.

And so here in this place, where wonderful tradition is expressed in the heaviest stone and the soundest oak, one renews his acquaintance with the pioneer—the man of action.

*An Address at the opening of the Class of Tuberculosis at the University of Edinburgh, October 1920.

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For, gentlemen, our genial host, your teacher and professor, Sir Robert Philip, stands in that light, the light of the pioneer, to us. He was among the first of a small group of sane enthusiasts who broke with the age-long tradition that the human race must, until the end of time, continue to suffer and die from that appalling disease, tuberculosis. Working steadily, surrounded by tradition but in no way bound by it, he has persuaded others notably resistant to persuasion, and has, by his efforts, created the most perfectly developed bit of machinery for the combat of this disease which exists, I think, in the world to-day.

In that remodelled church below the hill—the Dispensary—and in the various institutions in the country about, the effort to relieve those suffering from tuberculosis is made in a truly religious atmosphere—the religion of humanity in the city; the religion of the high ground, the running river and the fresh air, without the walls. You are indeed fortunate in your opportunity for instruction and inspiration in such surroundings and at his hands.

So much, for the moment, of Edinburgh. You will come to know the work well this year, I have no doubt, and some at least of you will help in the future development here and throughout your Empire. We came so far primarily to see and to learn.

Founded nearly twenty years ago by a generous American business man of Scottish ancestry (Mr Henry Phipps), the institution with which I am connected has been continuously associated with the anti-tuberculosis movement in our country ever since. To-day the Phipps Institute is an integral part of our University, and is supported by the united endeavour of the children of Mr Henry Phipps, the Pennsylvania State Department of Health, the Eagleville Sanatorium Association, and many charitably minded people in the city of Philadelphia.

In its organisation and work, the Institute follows largely the lines used here in Edinburgh with which you will become familiar as a part of your task of the year. Owing to many circumstances, the work of the Institute is much less complete on the side of caring for tuberculous patients than is the organisation here. We have, on the other hand, devoted more of our attention to investigation. We maintain a small hospital (Eagleville's portion of the work) which is intended to be used, and we hope will more and more be used, for the investigation

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of cases requiring unusual study or care. We operate a large out-patient clinic (under the State Department of Health as a part of their dispensary system). We maintain a corps of social service workers and nurses, and pay a considerable amount of attention to social questions and the conditions under which our patients live and work. We also conduct a well-equipped laboratory whose sole purpose is research in connection with tuberculosis and the diseases which resemble or are associated with tubercle. Our city is larger, our population entirely different, and our chief effort in all departments has been to study methods of care and treatment, incidentally caring for a moderate number of people. The actual care of most of the people is done by other agencies with whom we keep in touch. Our teaching is less systematic than here, less for medical students than for others interested in the problem.

My own function has been in connection with the laboratory, and you may permit me to give a brief summary of the tuberculosis problem as it appears to a laboratory man to-day.

1st. We know the cause of tuberculosis to-day as well as we know the cause of any infectious disease.

2nd. Efforts to make use of this knowledge in the way of developing a specific preventive (vaccination) or a specific cure have failed so far.

3rd. It is possible to obtain immunity reactions with the tubercle bacillus and its products. It is possible to protect animals against experimental tuberculosis by the appropriate use of the living tubercle bacillus. But no experimental method of vaccination is known which it would be safe to try on human beings to-day.

4th. Efforts have been made in various places (our Institute among them) to discover a specific method of treatment along the lines of the salvarsan treatment of syphilis or the quinine treatment for malaria—the method of Chemotherapy, as it is often spoken of. These studies are all recent; their progress has been interfered with by the war, and none of the results need come to your attention at this time.

5th. I think it is fair to say, and should be said to you who are on the threshold of your medical life-work, that the studies in this field have shown a most unfortunate tendency to become stereotyped—to follow the lines of precedent. Essentially the same experiments are repeated over and over again with slightly different materials and reported upon in

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different language—with the same negative result. This has been far too true in my time. I hope that your generation may bring fresh ideas to the subject. For fifteen years at least, we have been closely bound by tradition at its worst.

Now and then, however, one gets glimpses of fresh fields. These, when they appear, are tremendously stimulating and justify renewed effort and vigorous work. I am able to speak very briefly to you now of one of those satisfying results.

Taking origin in the train of thought which time does not permit me to develop to-day, experiments were begun at the Phipps Institute a year ago with the object of tracing, if possible, any influence which heredity might have on resistance or susceptibility to tuberculosis. The work has been possible through the co-operation of the Bureau of Animal Industry of the United States Government.

The Bureau has conducted experiments on the inheritance of important factors in the animal economy for a long time—the work now being in charge of Dr Sewall Wright. In the course of the Bureau's work a number of families or strains of guinea-pig have been subjected to continuous inbreeding—using brother and sister matings exclusively—and over a period of years. It is known that when this system is followed certain characters become the fixed property of the strain, and if they are sufficiently distinct can be recognised. Provided these characters are, as a whole, favourable in any particular strain, there need be no degeneration of the quality of the animals belonging to that strain. Inbreeding *per se* does not of necessity cause degeneration, popular opinion to the contrary notwithstanding.

Now, because of the governmental interest in questions relating to inbreeding for size, fertility, rate of growth, and questions related thereto, Dr Wright has kept elaborate records of the individual animals in the strains of guinea-pigs in question. These records serve to characterise the families in respect of such matters as colour, birth weight, number in litter, rate of growth, adult size, average length of life, the tendency to malformations, and the development of monstrosities. The stocks are, in other words, very well known in the sense of general biological character.

From these various strains—which to-day are five in number—Dr Wright has sent to Philadelphia all of the animals which were not needed for the continuation of the

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Bureau's work. Certain special matings have also been made for the particular purpose of our joint work. There have been crosses between the five strains in various ways. There is also available the original stock from which these inbreeding experiments were started—a stock in which matings between near relations have been rigidly avoided.

When received at Philadelphia these animals have been inoculated with tubercle bacilli, and the length of life after inoculation has been determined. The inoculations have been made with different doses of culture, in different ways, at different ages of animal, but always in large groups and in accordance with careful plans to develop the information required in regard to variations in resistance and the factors controlling it.

To-day I can do no more than refer to a few charts which summarise the matter as it now stands. The charts show the results with about 500 animals. Another series of 250 just finished has given the same general result. The factors—sex, birth weight, weight at inoculation, weight at 33 days of age, rate of gain and age at inoculation—have comparatively little influence on the result. Their total influence can be calculated as not more than 7 per cent. of the observed variation. On the other hand, one inbred family ($\dagger 35$) is much more resistant than two families ($\dagger 13$ and $\dagger 32$) which are more alike. Another family ($\dagger 2$) is intermediate in resistance. Crosses again in which the blood of family ($\dagger 35$) is present are more resistant than those in which this blood does not appear.* About 35 per cent. of the observed variation is thus accounted for on an hereditary basis. It seems to be clearly demonstrated that the opinion long held by many physicians, namely, that hereditary factors are of definite influence on susceptibility to tuberculosis is justified from the purely biological view-point.

Now, with relation to our text, "Pride of Blood," where are we? Let us again defer the point a moment and permit me to say that I hope that I have shown you that, starting with the study of tuberculosis and regarding it with something of the spirit of the pioneer, the man who masters tradition, you can—indeed you must—inevitably find yourself involved in the most intricate problems of pure science. The task is worthy of the best mettle of the best of you.

* A complete statement of our results will appear shortly in the *Journal of Experimental Medicine* and in the *American Naturalist*.

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The late Sir William Osler had much to do with the establishment and teaching policy of that great institution, Johns Hopkins University Medical School, perhaps the most scholarly in its traditions of any of our American schools to-day. It was his custom to say that it was possible to learn all of medicine by the study of typhoid fever and pneumonia. His teaching practice was largely built on that conception.

It is equally sound to-day to say that most of medicine will be known if you know all about tuberculosis—and you will know a good deal about surgery as well. So, if at times it should seem that your course is becoming unduly “tuberculous,” be patient in the thought that it is not what you study so much as how you study it that counts most. I hope that at least a few of you may approach this and other diseases through the path of laboratory science in the restricted sense, and that all of you will have regard for the traditionally scientific atmosphere of your school in your work with tuberculosis whether as clinicians or health officers.

And now for our pride in blood—our common blood.

The work which I have presented to you to-day is but a fragment, as you are doubtless aware, of a mass of scientific information about heredity and the forces surrounding it. It is a truism that blood counts—a truism which recent events have emphasised in tragic fashion. We are learning much about how it counts. May we not hope, in the light of the observations I have reported to you, to make blood count in the solution of the tuberculosis problem? It is against tradition to suppose that this can be—tradition which tells us that love refuses to be bound by the laws of hygiene. There is, however, an old saying—“You should not love for money, but you may love where money is.” Can you not, in the flower of your youth, be persuaded to love where health is?

We in America are accused of being money mad. We may be mad for luxury—we may be over-anxious to display our powers in the field of organisation—but we do not, as a nation, care for money; probably we do not care enough for money. On the other hand, we are in a position where we shall be more and more required to care for blood—not for estates, palaces, and castles, not for the traditional feudal nobility, but for essential blood—Anglo-Saxon—Scottish blood, if you will.

Through force of circumstances rather than intention, we already care more for essential blood in the hereditary sense

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than you seem to. We neglect human life and health as much as you. But the neglected blood with us is Negro blood, Chinese, Slavic, Italian, or Jewish blood. I do not seek to justify our carelessness of even this alien humanity, but it is sad beyond expression to see in your great cities to the south how often the miserable poor—the slum-dwellers—the women of the street, are of Anglo-Saxon blood—our own blood. This is still true with us in the country districts of certain regions. But an especial duty rests with you, I think, as doctors, and as men and women, to see that it becomes less and less true with you here. For this is the source—the source from which, if needed, a fresh supply of blood may be drawn.

And with us fresh draughts of this good, red, honest blood may yet be needed. Our forefathers had unlimited self-confidence but naturally a limited outlook in certain directions. They thought that, having acquired a new freedom, they could safely extend it to all comers freely. So that to-day in large areas of our country the original blood is being pushed to the wall by mere weight of numbers. Whole states are black, numerically speaking; large cities are German, others are becoming Slavic or Hebraic. Inevitable processes of miscegenation militate seriously against the conception more and more put forward in high quarters in your country, and in certain quarters of ours, that the United States should eventually, and soon, become an essential part of an Anglo-Saxon super-state.

What we know of heredity rather justifies another view—another hope—that from the crossing process now going on on a large scale there may result a new race with new, perhaps stronger, qualities—a race which may live amicably and co-operatively with the pure Anglo-Saxon which it is your duty and privilege to maintain. But it is evident that if such a happy outcome is to be achieved it can only be by maintaining, for generations more, a numerically strong strain of Anglo-Saxon.

The blood end of it we can probably manage for the present. But, intellectually, there is more immediate danger. It is to be hoped that in the future—not far away—when you young men and women are the leaders of your country's medical thought, there will be freer intermingling and the exchange professors, the confreres on special subjects, the visiting students, may not all be Latin or German. When that time comes, I hope you may find the same hearty welcome with us that we have to-day experienced at the hands of our British colleagues.

CRITICAL REVIEW

THE SURGERY OF GOITRE.

By J. N. J. HARTLEY, F.R.C.S.

IN a recent contribution, Halsted¹ relates in a fascinating manner the early history of thyroid surgery. The advent of Listerian principles and of anæsthesia, as in other branches of surgery, led to rapid developments, and especially was this the case in the surgery of simple goitres. Strumectomy soon became the recognised procedure for those simple goitres producing pressure symptoms. In 1883, Kocher had already standardised the operation of lobectomy, and the technique was so perfect that, with only minor modifications, it is still the one largely employed. These early decades constitute a distinct period in thyroid surgery. Not only was the operative procedure perfected, but many physiological discoveries of prime importance were made; thus it was found that total extirpation of the thyroid led to the peculiar condition named by Kocher "*cachexia strumipriva*," and, not long thereafter, the syndrome of tetany was described, and its relationship to the parathyroids proved.

Exophthalmic goitre offered a much more serious problem. The statistics of the early series of operations presented a mortality almost prohibitive, and even by such expert surgeons as Kocher the operation was at first deemed unjustifiable. Indeed, it was not until after 1900 that Kocher began strongly to advocate surgical treatment in cases of exophthalmic goitre.

During the last two decades another era has arisen in thyroid surgery, an era which will always be associated with the surgery of "toxic" goitres. For the progress that has been made in surgical therapy in this group of goitres, credit is due alike to the biochemist, clinician, and surgeon.

In 1914, Kendall² succeeded in isolating the active principle of the thyroid gland as a colourless crystalline solid. This when given to myxœdematous patients caused all the symptoms of myxœdema to disappear, and when given in excess led to manifestations of hyperthyroidism. The active principle was analysed, and, in 1917, Sterberg³ succeeded in synthesising a small quantity. In order to indicate the oxy-indol nucleus, Kendall named the substance "thyro-oxy-indol," and, for brevity, "thyroxin."

Following on this discovery, Plummer carried out extensive research on the relation of thyroxin to metabolism. It was found that the rate at which energy is produced by the normal organism is

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largely controlled by the amount of thyroxin within the tissues of the body: though not the only factor, the thyroid secretion is probably the one most potent in governing the speed at which energy is produced. The basal metabolic rate, which is defined as the total heat production per hour per square metre of body surface, with the subject at rest and after 'twelve hours' fast, does not fluctuate more than 10 per cent. above or below the average. (The basal metabolic rate can be estimated by the calorimeter. The indirect method, however, is more convenient, and is sufficiently accurate for clinical purposes. The data required are: the total air inspired in a given time, and the respiratory quotient: also the body weight and height, for determining the surface area of the body.⁴) Patients with complete atrophy of the thyroid have a basal metabolic rate about 40 per cent. below normal: in exophthalmic goitre cases, the average metabolic rate is 57 per cent. above normal. It has been shown that 1 mg. of thyroxin, in an adult weighing 150 lb., increases the metabolic rate 2 per cent., and the curve of response from 30 per cent. below normal to from 15 to 20 per cent. above normal is approximately a straight line.⁵ Experiments demonstrate that thyroxin, after administration, functions as long as fifteen to twenty-one days. It has been calculated that the total amount of thyroxin in the tissues of the body of a normal person is probably about 13 mg. Experiments on dogs and goats⁵ have led to interesting results. Small repeated doses of thyroxin were found to be more potent than when combined and administered in a single dose. After a large injection most of the iodine contained in the thyroxin was excreted forthwith in the bile and the urine. It would seem that the absorption of the thyroxin by the tissues from the blood is slow, and that which is not absorbed is excreted by the liver and the kidneys. Indeed, by the administration of a certain quantity in small doses an animal may be killed, while the same quantity given in one single dose may produce little or no change. From this Plummer surmises that the lethal effect is not due to the thyroxin itself but to secondary effects which it brings into play.

These few findings will serve to illustrate the importance of Plummer's investigations on the relationship between metabolism and thyroxin. The discovery of a means of accurately estimating the degree of thyroid activity has undoubtedly laid a more sure foundation to the scientific study of the thyroid gland in health and in disease. From the clinical point of view, a valuable diagnostic aid has been instituted, and, from the therapeutic point of view, an accurate method has been established for determining with precision the value of the various therapeutic measures adopted.

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Non-toxic Goitres.

According to the absence or the presence of manifestations of hyper-thyroidism, goitres are now divided clinically into two groups—the “simple” and the “toxic.” Though the groups are not absolutely defined, the classification is nevertheless of great clinical importance. In toxic goitres it may be said that the clinical picture is dominated by the general manifestations of hyper-thyroidism, whereas in simple goitres the injurious effects of the thyroid enlargement are chiefly local.

The simple goitre may be either a diffuse parenchymatous overgrowth of the thyroid gland with or without visible colloid cysts, or it may be an enlarged thyroid due to the presence of adenomata or cystic adenomata. The thyroid may attain enormous size and may cause considerable deformity, and, for cosmetic reasons, may justify operation. More frequently, surgical treatment is demanded because of symptoms arising from pressure on the trachea, the œsophagus, the recurrent laryngeal nerves, or the large cervical veins. Occasionally, foci of degeneration lead to general toxic manifestations, and, when such symptoms are present, it is generally agreed that surgical treatment is called for. The adenomatous type of simple goitre is very prone to lead to an insidious variety of hyper-thyroidism. According to Tincker, adenomatous goitres are not relieved by medical treatment and do not disappear spontaneously, and since so many eventually give rise to pressure symptoms and hyper-thyroidism, he believes that operative treatment is generally indicated. The importance of simple goitre is enhanced by the increasing clinical evidence that it is a predisposing cause of thyroid cancer. Balfour,⁷ in a series of 6359 cases of goitre other than exophthalmic goitre, found cancer in 1.6 per cent. In nearly all the cases of cancer of the thyroid, there had been a long history of pre-existing goitre, and in 46 per cent. the condition was not suspected until it was discovered during the course of the operation, or, later, by post-mortem examination. He maintains that the similar appearance of the benign nodules and early malignant masses renders diagnosis extremely difficult, and is a strong argument for early operation in cases of nodular goitre. Particularly urgent is surgical treatment if a long-standing nodular goitre suddenly exhibits increased rapidity of growth.

One variety of simple goitre, namely, the goitre of adolescence, though rarely requiring surgical treatment, is worthy of special mention because of its frequent occurrence. It appears at puberty or in the succeeding ten years. Like the enlarged thyroid of pregnancy, the acini are dilated and filled with normal colloid. In this condition the physiological demand seems to be for more thyroid hormone. The majority of such enlargements disappear spontaneously or

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under a course of iodides or thyroid extract. Only those cases which resist treatment and which are troublesome because of pressure symptoms, or are unsightly, demand surgical treatment. Marine and Kimball⁸ have carried out experiments on a large scale, and they find that 2 grs. of sodium iodide in 0.2 gramme doses daily, for ten consecutive days, repeated each spring and autumn, will almost entirely prevent the enlargement of the thyroid in adolescence.

Attention has been drawn to the importance of laryngoscopic examination in all cases of simple goitre, since one cord may be paresed with little alteration of voice. Matthews,⁹ in 1000 consecutive cases, found 25 per cent. with one cord affected, and 1.7 per cent. with both cords affected. In those cases with one vocal cord paresed, particular care at operation should be taken to avoid injury to the opposite recurrent laryngeal nerve.

Radiograms have been found valuable in showing the extent and location of thyroid enlargements, and in determining the position of the trachea.

The operative treatment of simple goitre has long been one of comparative safety. From 1900 to 1905, Kocher extirpated 904 simple goitres, with only three deaths. The operation of Halsted, a pioneer of thyroid surgery, is generally regarded as the classical mode of procedure, and, as it has been recently described again by its distinguished author, it may be briefly outlined. A low collar incision is employed. The sternothyroid muscle is retracted outwards or split; Halsted maintains that it is a much cleaner dissection if none of the inferior hyoid muscles are cut. The upper pole is hooked forward and cut across between clamps. The lobe is rolled in and the external capsule incised and sponged back. The vessels as they penetrate the thyroid tissue are clamped, well away from the parathyroids and the recurrent laryngeal nerves. By a blunt dissector the isthmus is next separated from the trachea, transfixed, and generally ligated. Clamps are placed at various points around the portion of the gland lying adjacent to the trachea and the oesophagus, and the gland is divided from within outwards, just distal to the clamps. With fine silk, the raw surface is buried and the vessels of the capsule occluded. The special features of this operation are that the superficial veins of the neck are preserved; no muscle save the platysma is divided; the sternothyroid muscle is retracted laterally or occasionally split; delivery of the superior pole before the remainder of the gland is dislodged; resection in place of total lobectomy, in order to protect the parathyroid glands and the recurrent laryngeal nerves; ligation of the vessels well beyond the origin of the parathyroid arteries, and closure of the wound without drainage.

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Mayo divides the sternohyoid and sternothyroid muscles high up, should they appear to be in the way, and carefully resutures them at the end of the operation. In simple goitres, he believes the operation of choice is removal of the isthmus and a bilateral resection of the lobes. He likewise lays emphasis on the importance of leaving thyroid tissue attached to the posterior part of the capsule, and likewise on the necessity for care in applying forceps, in order to avoid injury to the parathyroids and the recurrent laryngeal nerves.

In cystic goitre, Ballin⁶ prefers to remove the isthmus and both lobes, save the upper poles, since he finds that the upper poles are the most unlikely parts of the thyroid to contain cysts.

De Quervain¹⁰ has carried the principle of primary ligation of blood-vessels to a logical conclusion, and, as the first step in his operation, ligates the inferior thyroid artery as it lies behind the carotid sheath. After making a collar incision, the medial border of the sternomastoid muscle is retracted laterally. A vertical slit in the sternohyoid fascia is made, and the wound is deepened laterally to the external capsule of the thyroid gland. The carotid artery is defined and retracted laterally. The inferior thyroid artery is readily found running transversely behind the carotid artery and lying in the space between the carotid fascia and prevertebral fascia. After the inferior thyroid artery has been carefully isolated and ligated, the thyroid gland is approached more medially by incising its external sheath. In difficult goitres, especially, he ligates both inferior thyroid arteries and the anterior branch of both superior thyroid arteries before performing a bilateral resection of the thyroid lobes. By saving the posterior branch of the superior thyroid, he ensures a good blood supply to the parathyroids. This operative procedure, he believes, is most efficacious in protecting the parathyroids and the recurrent laryngeal nerves. He admits there is some risk to the cervical sympathetic nerve, but, with due care, injury can readily be avoided. There is little doubt that a bilateral resection leads to more symmetry of the neck and gives better cosmetic results; further, it enables the surgeon thoroughly to explore both lobes, and there is thus less risk of adenomatous nodules and early malignant disease being left unrecognised.

Adenomata may either be single or multiple, and not infrequently occur in diffuse parenchymatous goitres. If, clinically, the adenoma appears to be single, it can readily be removed by incising the capsule and substance of the thyroid down to the tumour and shelling it out; if multiple adenomata be present, as already stated, a bilateral resection of the thyroid would appear to be the method of choice.

Sub-sternal Goitre.—Mason¹¹ notes 5 cases of sub-sternal goitre, all showing thyro-toxic and pressure symptoms, and all were adenomatous. Lahey¹² makes a study of 65 cases, 4 being intra-thoracic

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adenomata, 1 an intra-thoracic thyroid cyst, and 60 with partially intra-thoracic thyroid growth. He finds that, when a colloid goitre projects into the thorax, the goitre frequently shows calcification. Periodic attacks of respiratory obstruction occurred in almost every case; indeed, in some the respiratory symptoms led the physician to a mistaken diagnosis of asthma. Radiographic examination was found valuable: the sternal shadow was widened, and in some was continuous with the thyroid shadow above. When the intra-thoracic growth was asymmetrical, the trachea was displaced and could readily be recognised in the radiogram. Fluoroscopic examination was helpful, since the ascent and the descent of these thyroid tumours differentiate them from other mediastinal growths. Intra-tracheal examinations were likewise of service in detecting deviation, narrowing, or bending of the trachea from pressure.

In the treatment of sub-sternal thyroids, it is advised to deliver the tumour in one piece. There is usually a well-marked adventitious capsule, in which the surgeon works, and thereby avoids injury to important vessels and the recurrent laryngeal nerves. Further, the capsule left limits the spread of any blood that may issue from small vessels. Only in one case was it necessary to enlarge the thoracic aperture by splitting the sternum and prising the two halves apart by a wedge. The blood supply chiefly comes from above, through the inferior thyroid arteries and veins, and hence the vascular pedicle can be dealt with after delivery of the tumour, and will cause little bleeding. Ochsner found, in several cases, that patients coughed after delivery of the tumour, and ruptured the pleura. Now, he immediately places a moist sponge in the space produced after the tumour is dislodged before proceeding with the rest of the operation. Mayo leaves in a drain for a few hours only, in order that the cavity may not fill with blood clot; otherwise, in such cases, drainage becomes indefinite.

Toxic Goitre.

Of the goitres which produce toxic symptoms, the exophthalmic goitre was for a considerable time the only type clearly defined. First Parry, then Grave, and later Basedow, detailed the clinical picture, and, in 1893, Greenfield revealed the pathological findings which characterise this disease. Many atypical forms, however, were encountered, and became variously known as Chvostek's disease, kropfherz, goitre basedowifié, and formes frustes. Kocher expressed a belief that these were mitigated forms of Graves' disease; some, he believed, were Graves' disease superimposed on a colloid goitre. Within recent years, this ill-defined group has apparently resolved itself almost entirely into a well-defined clinical entity, which has been

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termed "adenomata with hyperthyroidism." For the elucidation of the pathological and clinical manifestations of this variety of toxic goitre, chief credit is due to Plummer.¹³ While serving in the Mayo Clinique, this worker has had almost unequalled opportunities of carrying out his investigations, for in this Clinique alone there have been no less than 10,000 operations for toxic goitre, and almost an equal number for simple goitre. The teaching of Plummer is confirmed by many other competent observers, notably by Frazier, Judd, and Crile.

It is only possible here to refer briefly to the salient points which have been found to differentiate the two groups of toxic goitre. In exophthalmic goitre, the characteristic change of the thyroid gland is one of diffuse hyperplasia of the parenchyma. In toxic adenomata, as the name implies, the thyroid enlargement is due to adenomata. These vary in size and number, and may present areas of degeneration, rarely foci of hyperplasia. The surrounding thyroid tissue may be normal or may present changes similar to that of colloid goitre. Occasionally, embedded in the thyroid tissue, are areas of hyperplasia, and then the condition must be regarded as intermediate between the exophthalmic goitre and the toxic adenomata. It is of interest to note that Marine has found the adenomata to contain iodine, and Graham has discovered by tadpole experiment that they contain a hormone possessing the same physiological action as thyroxin.¹⁴

Both types of toxic goitre are associated with increased metabolism, tremor, nervousness, loss of weight, tachycardia, and, in the later stages, degeneration of the cardio-vascular system, as evidenced by dyspnœa, arrhythmia, œdema of the ankles and legs, and, maybe, auricular fibrillations. The syndromes associated with each are, however, sufficiently distinct to render differential diagnosis relatively easy. In exophthalmic goitre, the symptoms appear as a rule within a year of the appearance of the thyroid swelling, and rapidly progress, and culminate in a crisis from which the patient generally recovers partially and then is liable to have a series of relapses, after each of which the cardio-vascular system tends to become more and more disorganised. The average age for the onset of symptoms in a series of cases of exophthalmic goitre was 37. The symptoms in toxic adenomata appeared on an average ten years later, and hence the disease is one of middle life.²⁰ Moreover, the symptoms supervene on a thyroid enlargement which has existed for ten or twenty years. The onset is very insidious: for two or three years previous to examination the patient as a rule has become somewhat nervous and excitable; though the appetite has been good, the patient has remained thin and has tended to lose weight: the skin is generally moist. Later, moderate tremor, loss of strength, and breathlessness

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on exertion appear. In long-standing cases, a cardio-vascular breakdown is liable to ensue, as manifested by oedema of the legs and ankles, and maybe by physical signs of auricular fibrillations. It is this group of cases which, in its earlier stages, has often been mis-diagnosed. One syndrome which is liable to be confused is a variety of psycho-neurosis with tremor and tachycardia. Especially is the error likely to occur if there should also chance to be present a goitreous enlargement. The condition, however, can always be easily differentiated by the basal metabolic rate, which, in psycho-neurosis, is not increased.¹⁵

Though it is well known that certain mild cases of exophthalmic goitre recover spontaneously and that a certain percentage recover or are improved by medical treatment, those with most experience are becoming more and more agreed that surgery gives a higher percentage of cures than any other measure. Concerning X-ray treatment, on which physicians have so largely relied, Sir Hector Mackenzie¹⁶ has recently admitted that in many cases it produces little improvement, and even with many applications over a long period of time a cure is rarely effected. Just what cases will be cured by non-surgical treatment it is almost impossible to determine in the early stages of the disease. Frazier,¹⁷ however, in very mild cases, says that operative treatment is not urgent, and he first tries change of occupation, care of the teeth, and removal of infected tonsils. If the mild toxic condition persists but is not handicapping the patient, the question of operation should be left to the decision of the patient himself. In moderate cases operation is urged. Though a certain number of such cases may recover by medical treatment, they are subject to recurrences, and every recurrence leaves the patient a poorer surgical risk. Mears and Aub¹⁸ say that if rest and drugs, combined with X-rays, fail to restore the basal metabolism to within 20 per cent. of the normal, then there is a plain call for surgery, unless the patient's condition will not warrant operative interference. According to Terry,¹⁹ toxic adenomata are not curable by medical means, including X-rays, and he believes from the first the treatment should be surgical.

Judd¹⁵ analyses the results of thyroidectomy in 100 cases. There were 65 per cent. of cures of patients with more severe types of hyperthyroidism, and he believes the percentage would be considerably higher had the operation been undertaken earlier and with a better understanding of the plan of treatment. More than 80 per cent. of the patients suffering from adenomata with hyperthyroidism were relieved of the toxic symptoms and a cure obtained by thyroidectomy, notwithstanding that some of the cases were late in receiving surgical treatment. Frazier analyses the results of cases

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treated before the war, and finds that 80 per cent. recovered completely or sufficiently to enable them to resume their occupation.

The operative mortality, which formerly was so formidable, has within recent years been greatly reduced. What is possible by modern methods is illustrated by two recent series of cases. Frazier,¹⁷ in 339 cases of toxic goitre, resected the thyroid, with only a little over 1 per cent. mortality. In a series of 300 exophthalmic goitres operated on by Crile,¹⁴ the operability was 100 per cent. and the mortality rate 1 per cent. That the operative mortality rate has been so greatly reduced is attributed to two main factors—firstly, cases are being treated in the earlier stages of the disease at a time when they are better surgical risks; secondly, the surgeon has learned better judgment in selecting the type of operation which is the best and safest in any given case.²¹

Before outlining the more important operations which are now employed in cases of toxic goitre, it is necessary to refer briefly to the question of estimating surgical risk. So important is surgical risk in determining the line of action taken by the surgeon, that numerous attempts have been made to discover some objective sign that will form a reliable index. The metabolic rate gives an accurate estimation of the degree of hyperthyroidism, but it does not indicate the amount of damage already done to the cardiovascular and other systems. Sistrunk,²¹ however, believes that it serves as a partial guide. He carefully selects the type of operation for patients with a metabolic rate 40 per cent. above normal, and hesitates to do a primary thyroidectomy in patients with a metabolic rate 60 or 70 per cent. above normal. The epinephrin test (Goetsch) has been found to be unreliable as a diagnostic test by several investigators.¹⁷ Judd¹⁵ states that, in his experience, it neither agrees with the clinical picture nor with the metabolic rate; indeed, he obtained the best response in certain psycho-neurotics. The lymphocyte count was found by Frazier¹⁷ to be of little use in estimating the tolerance of the patients to surgical therapy. It would seem that, thus far, no single objective sign has proved absolutely reliable in determining the degree of surgical risk, and the surgeon is wise to take into account the composite clinical picture which includes all the signs and symptoms primarily associated with hyperthyroidism and those resulting from secondary degenerative changes in the cardio-vascular and other systems. Patients who are rapidly approaching or have attained the height of a wave of hyperthyroidism, possibly with vomiting and diarrhoea and acute mental excitement, are admittedly bad subjects for operation, and nearly all are agreed that such cases should be tided over the critical period by rest, fluids, and careful nursing, until a more favourable opportunity presents itself. Those

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patients who already have marked visceral complications, especially myocardial degeneration, manifested by rapid and irregular pulse, ascites, and oedema of the feet and hands, are likewise cases in which operation is precluded. The estimation of surgical risk is not only of importance in excluding those cases that will not tolerate any operative interference, but also in deciding which of the graded operations should first be employed in any given case. It need only be remarked that when a surgeon is in doubt as to the risks of a major operation, all are agreed that he should err on the safe side and do a preliminary minor operation.

The object of surgical therapy may be said to be the ablation of sufficient hyper-functionating thyroid to restore the basal metabolism to the normal. In toxic adenomata, a partial thyroidectomy or removal of an adenomatous mass results in a rapid disappearance of the symptoms of hyperthyroidism. C. H. Mayo²⁰ found the average basal metabolic rate to fall from 35 per cent. to 7 per cent. above the normal, and usually within two weeks. In exophthalmic goitre, Sistrunk²¹ states that to bring the metabolic rate to nearly normal, it is necessary to remove all of one lobe, the isthmus, and the greater portion of the other lobe, leaving only a portion half or one-third the size of a normal thyroid lobe. Even then, in a few cases, this portion hypertrophies and may occasionally necessitate a second operation. Such a radical procedure, however, in many cases, is fraught with too great danger, and it is then that the "step" operation must be resorted to. Various graded operations are in vogue, but that of Crile¹⁴ will serve to illustrate the principle. He recommends that, in grave cases, the ligation of one thyroid artery, the ligation of a second thyroid artery, a partial lobectomy, and a complete lobectomy should be performed, with one month or more between the various steps. Of the minor preliminary procedures, the ligation of the superior thyroid artery is the one most frequently practised. Frazier ligates the superior thyroid vessel when the patient has a metabolic rate over 60 per cent., or when the metabolic rate is lower, and signs of great toxicity are manifested by a rapid pulse, much loss of weight, restlessness, sleeplessness, and marked vaso-motor disturbance, Sistrunk²¹ states that in cases with a metabolic rate of 60 or 70 per cent. above normal, without marked cardiac damage and apparently otherwise good risks, he does a preliminary ligation. If only a moderate reaction follows, a thyroidectomy is performed after seven or eight days, but if a severe reaction occurs, he considers it wiser to do a second ligation and to wait three or four months before performing a thyroidectomy. The ligation of a thyroid artery is generally regarded as a preliminary measure to a more radical operation. Mayo, however, states that, in very mild cases, it alone may

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effect a cure, and Rogers⁶ has claimed, by ligation of the four thyroid arteries, a cure in 70 per cent. of cases. The superior thyroid artery, for anatomical reasons, is the one first ligated, and Mayo recommends that this be ligated after it has divided into its two terminal branches. The upper pole is isolated and surrounded by two ligatures and divided between, the tissues included in the ligatures being thyroid tissue, cervical sympathetic fibres and lymphatics, in addition to the two divisions of the superior thyroid artery. Care must be taken not to include any portion of the omohyoid muscle, since such muscle, by contracting, may dislodge the ligature and lead to troublesome hæmorrhage.²² Frazier¹⁷ points out that the results of ligation of the superior thyroid artery vary considerably, and possibly this is accounted for by the variation in the relative size of the superior and inferior thyroid arteries. Even in those cases where the operation leads to little improvement in the patient's condition, it nevertheless serves a useful purpose, for the reaction which follows the operation is a very good index to the degree of reaction that may be anticipated after the final thyroidectomy.

Other two minor procedures may be mentioned. In severe cases of hyperthyroidism, Miles Porter²³ advocates the destruction of small areas of thyroid tissue by the injection of boiling water repeated at intervals of a few days, until the patient becomes a safe surgical risk for the more radical operation. Mason¹¹ prefers fractional cauterisation by means of an electric cautery, and believes it to be more effective than boiling water.

The radical operation for toxic goitre is beset with many mooted points. The anæsthetic to be employed is still very far from being generally agreed upon. Dunhill,²⁴ Bartlett,²⁵ Eastman,²⁶ and Ochsner²⁷ make considerable use of local anæsthesia. Dunhill and Bartlett prefer not to combine the effects of morphine, as they find it tends to make the patient sick on the table. C. H. Mayo²² uses local anæsthesia in cases with special respiratory difficulty and myocardial lesions. He prefers, as a rule, however, a general anæsthetic combined with $\frac{1}{4}$ grain morphine and $\frac{1}{100}$ grain atropine, twenty to thirty minutes before, and then open ether, with the head raised. Crile advocates nitrous oxide and local anæsthesia, and attempts to "steal" the gland without the patient being aware of the nature of the operation. Frazier¹⁷ uses Crile's anoci-association technique, and believes local anæsthesia alone to be contra-indicated.

Eastman²⁶ discusses the relative value of local and general anæsthesia in operations on the thyroid, and points out that local anæsthesia enforces gentleness in manipulation and thereby reduces the post-operative hyperthyroidism. The use of local anæsthesia minimises the post-operative sickness, and allows the patient to take

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fluids and nourishment almost immediately, both being of importance in toxic goitres. The heart, kidney, and liver, already taxed, may not withstand the deleterious effects of a general anæsthesia. In local anæsthesia, one is often warned when the recurrent laryngeal nerve is in danger of being injured. As Goetsch²⁷ points out, however, the psychic element is of extreme importance in toxic goitres, and is reduced by general anæsthesia. He has noticed that the pulse-rate falls under the anæsthesia, and he believes this to indicate that the patient is better off under a simple general anæsthesia than under local anæsthesia alone. Ochsner²⁷ has found, after careful comparison in a large number of cases, that patients with local anæsthesia were in better condition the day following the operation than those who had had general anæsthesia. He states, however, that, by performing gastric lavage with water at 105° F. immediately after the operation in cases in which a general anæsthesia was used, such patients were almost in the same position as if only local anæsthesia had been employed. Though local anæsthesia alone enforces gentleness of manipulation, it is no argument against the use of general anæsthesia, for such anæsthesia does not necessarily entail less delicate manipulation. Under general anæsthesia there is complete relaxation, and the surgeon can work more quickly.

As to the operation itself, Crile lays emphasis on the advantage of leaving a little of the gland tissue adherent to the posterior part of the capsule. This minimises injury to the recurrent laryngeal nerve and parathyroids. Such a layer of thyroid tissue, Frazier states, he has always found sufficient to obviate the onset of myx-œdema. In sharp contrast with the above, which is the procedure most generally advocated, is the operation of T. P. Dunhill.²⁴ This surgeon maintains that to leave a layer of thyroid tissue adherent to the posterior capsule enhances the danger of post-operative hyperthyroidism. In certain cases this layer of thyroid tissue hypertrophies, in which case a subsequent operation to remove the new thyroid tissue embedded in scar tissue and adherent to the trachea is a difficult problem. Accordingly, he dissects the lobe carefully from the trachea and larynx, making certain of leaving no little outlying protuberances of thyroid tissue. He does not employ ligation of thyroid vessels as a preliminary operation in severe cases. In many cases, however, he only completes the radical operation to two or more stages. At the first operation he generally removes one lobe and the isthmus: the divided surface he does not crush, and he disturbs as little as possible the tissues around the remaining portion of the thyroid. The second operation he usually performs three or four months later, and approaches the undisturbed portion of the gland and works towards the previous raw surface: at this

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operation he removes all the thyroid tissue save the upper pole, which is left as undisturbed as possible.

In those cases where a post-operative reaction is likely to occur, Bartlett²⁵ adopts a special technique for thyroidectomy, which he believes has reduced shock and lessened the tendency to post-operative hyper-thyroidism. An oblique incision is made just posterior to the anterior border of the sternomastoid muscle; skin sutures are inserted, left untied, and retracted out of the way. The sternomastoid muscle is retracted laterally, and the inferior hyoid muscles split over the most prominent part of the thyroid swelling. The exposed lobe is gently caught in peritoneal forceps and lifted up, and the wound flooded with alcohol to seal up all tissue spaces. The upper pole is divided between forceps; the capsule and goitre substance are divided, after clamping the vessels from above downwards. No vessels are tied, the artery forceps being merely bunched lightly together. The wound is left freely open. The clamps are all unlocked in twenty-four hours save those on the superior thyroid vessels. The skin stitches are tied in forty-eight hours. He maintains that this technique shortens the operation, avoids as far as possible the separation of tissue planes, and allows perfect drainage, and thereby minimises post-operative "storm." The oblique incision, although not yielding the same cosmetic result as the collar incision, is considered justifiable in these serious cases since it gives most direct, rapid, and bloodless approach to the gland.

In serious cases of primary Basedow's disease, Ballin⁶ practises an operation which he terms "transfixion of the gland." The thyroid is exposed through a small transverse collar incision, the infrahyoid muscles being separated. A No. 2 chromic catgut, continuous or interrupted stitch is run through the gland from the upper pole downwards, one or both lobes being thus treated. As large a mass as possible of thyroid tissue is included in the stitch, care being taken not to infringe on the posterior part of the capsule. The result is that along this chromic catgut the glandular tissue is replaced by scar tissue, and the greater part of the parenchyma atrophies. He has applied this method twenty-six times in a series of 200 cases of Graves' disease. Several of the cases were cured completely, and only one had a recurrence. There was no case mortality.

In the post-operative treatment Bartlett gives a $\frac{1}{2}$ gr. morphine, and repeats as often as the respiratory rate goes over twenty and pushes hypodermoclysis. Crile¹⁴ compares hyper-thyroidism to heat shock, and believes it to be the antithesis of surgical shock. He employs ice-bags freely in order to lessen the tendency to high temperature and increased pulse and respiratory rates.

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Relationship of the Thymus Gland to Toxic Goitre.

Blackford and W. P. Frelich,²⁸ as a result of their studies of 117 necropsies on cases of goitre, found that thymus hypertrophy was universal in young subjects with hyperthyroidism and was often lacking in old people. The rule appeared to be that hypertrophy of the thymus was inversely proportional to the age of the patient and directly proportional to the duration of the disease. Accordingly, they believe the thymus hypertrophy and lymphoid hyperplasia should be considered a result rather than a cause of the intoxication in hyperplastic goitres. Garré²⁹ stated that 95 per cent. of the operative mortality in Basedow's disease was due to a persistent thymus, and believed that thymectomy should be added to strumectomy. According to Judd,³⁰ however, the operations have proved difficult, and the results of such operations do not warrant the procedure as a routine. Frazier¹⁷ believes that an enlarged thymus is undoubtedly responsible for many of the sudden deaths following operation, and, when he suspects an enlarged thymus, gives a preliminary course of X-ray treatment.

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LETTER FROM VIENNA.

(*From our Correspondent.*)

HEALTH INSURANCE IN AUSTRIA.

HEALTH insurance in German Austria, with which this letter is concerned, has for years been a sore subject to those working it, and from time to time it has also played a role in the arena of party politics. Latterly, the conditions as regards sickness insurance have become more acute, and it may therefore be of interest to those outside Austria to learn what is going on there in this important matter. In what follows, when Austria is spoken of, it must be understood that the state of matters in Vienna, which is typical of what exist throughout the country generally, is especially referred to.

Until quite recently there existed, apart from a few small Friendly Societies which paid sick money to their members but did not provide medical attendance, only Sickness Insurance Associations (*Krankenkassen*) with salaried medical men (*Kassenärzte*). According to this method, the insurance doctor received a fixed sum yearly, in return for which he undertook to attend gratuitously all the insured persons dwelling in his district. Whether the work was light or heavy his wage remained the same. As a rule the number of insured persons in these associations was very large and the number of doctors small, and the salary worked out at so ludicrously small a sum per attendance that the doctors could not possibly rest content with their position. Moreover, they were overburdened with clerical work, and were often subjected to indignity by the lay officials. The system was also felt to be unsatisfactory by the patients, inasmuch as they quite correctly recognised that in such circumstances adequate treatment was not afforded. Many also objected to their choice of a doctor being restricted to the particular medical man who served their district. From both parties, therefore, but especially from the side of the doctors, a demand for relief arose.

Some of those interested in the matter thought that the best remedy would be to introduce a system of pure disability insurance, according to which the insured person in case of sickness received a definite allowance, out of which he had to provide the cost of medical attendance and medicine. The strong reasons urged against this plan were that it would involve the appointment of medical inspectors to check abuses, and that many of the insured would never call in medical aid at all, but would spend the allowance on other objects. Another proposal which found advocates was that there should be a limited free choice of doctor; *i.e.*, that the insured person should have the right to call in any doctor on the panel of the association, and that payment

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should be by the number of attendances. The proposition presented allurements to both parties, for it was known to work satisfactorily in some cities, such as Innsbruck. Whether, however, it would prove as well adapted to the needs of a large community like Vienna, where the doctors number thousands and the insured hundreds of thousands, it was impossible to foretell. The big insurance associations in Vienna have until quite lately adhered obstinately to the system of paying the doctors at a fixed salary, and only now are some indications of a change of opinion beginning to show themselves. On account of the long-continued distressing financial conditions of the country the insurance associations are no longer in a position to pay the salaries agreed on, and thus the way is opened up for disability insurance pure and simple, with, as a corollary, free choice of doctor. If this takes place, the present insurance doctors will require to be compensated, but this does not seem to present insuperable difficulties. The associations had recently come to an agreement with their doctors for attendance on the families and dependents of the insured members, but these agreements came to an end in January 1921 and have not been renewed. One association has arranged for disability insurance of the families of its members, but the others have taken no steps in the matter.

While hitherto the insurance associations have concerned themselves mainly with persons who by reason of illness *ipso facto* lost their wage—the working class—a quite recent development is the foundation of insurance associations for another class—persons whose salaries continue in spite of their being laid aside by illness. The principal of these is the *Kranken-versicherungs Anstalt der Bundes-Angestellten*, which seriously affects the Austrian medical profession, inasmuch as it withdraws from the sphere of private practice many hundreds of thousands of patients, since it includes all acting and retired civil servants and officers and their families. It must, however, be stated there are included among these a great many persons who were never able to pay the fees of a private doctor. The scheme is based on a limited free choice of doctor from a panel; if the patient wishes to have a doctor who is not on the panel of his district he can obtain his services on payment out of his own pocket of an extra fee. The medical fees in this scheme are relatively small: 17 kroner for a consultation, and 34 kroner for a visit; specialist fees are thrice the above, and various special services are proportionately remunerated. The existing agreement will soon terminate and the doctors are now asking that the fees should be doubled. Many, however, are entirely opposed to any renewal of an agreement of this nature, and are standing out for disability insurance only. Moreover, it is as yet uncertain whether this whole scheme is sound financially; there are many strong doubts as to its feasibility from this point of view.

New Books

Another large group, the municipal employés of the city of Vienna, are attempting to introduce an insurance scheme, on the disability insurance plan, as opposed to that of the civil service, but so far it has not materialised, and the financial provisions of the draft scheme have not been favourably received.

Legislation is promised for the immediate future which will enroll the whole agricultural community in an insurance association. This will almost completely deprive the country doctor of any private practice, and will seriously damage his position.

NEW BOOKS

Psycho-analysis and Its Place in Life. By M. K. BRADBY. Pp. viii + 266. London: Hodder & Stoughton. 1919. (Oxford Medical Publications.) *The Logic of the Unconscious Mind.* By M. K. BRADBY. Pp. xiv + 317. London: Hodder & Stoughton. 1920. (Oxford Medical Publications.) 16s. net.

In these two volumes Miss Bradby gives a sane account of modern psychological teaching, and as popular expositions of the subject they rank high and deserve to be widely read, especially at a time when the jargon of psychology flows so glibly from the pens of authors, quasi-scientific or adventurers on the field of romance, who are equipped only with a smattering sufficient to mislead their readers. In the volume on psycho-analysis there is first a description of the unconscious mind, which is here and throughout the book viewed from the standpoints of its being a normal but undeveloped mind, and its relations to the mental processes of the primitive are discussed. Psycho-analytic theory is next considered, and in a general way adhesion is given to the views of Freud and Jung. Then comes a section dealing with dream interpretation, and the remainder of the book is mainly occupied by an attempt to relate psychology to life—firstly, by a return to what had already been hinted at in the early part of the book, viz., the similarity of the working of the unconscious mind in civilised persons, to the mental processes of primitive people, and secondly, by a consideration of its bearings on ethical and moral problems. The book is very suggestive and interesting throughout, and Miss Bradby has quite obviously thought over and studied her subject carefully. The parts of her chapters which appealed most strongly to the reviewer as likely to be read with profit by students are those in which an attempt is made to illuminate anthropology by the light of psycho-analytic studies, and her exposition of dream theories. The last is, practically,

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one of the most important aspects of the subject from the point of view of introducing it to novices, for it is open to anyone, by analysing his own dreams, to test the general validity of the theories and in point of fact it is in this way that most persons become converted to the doctrines of repression, symbolism, etc.

The Logic of the Unconscious Mind may be described as a sketch of the parts that reason, on the one hand, and prejudice, on the other, play in human affairs. It is granted that with the development of the race, and the spread of knowledge, explicit reasoning is coming to assert its place. Miss Bradby, however, does good service in pointing out to what a large extent the apparently reasoned opinions and decisions of man are coloured and guided by emotions and tendencies arising from the unconscious. In the reviewer's opinion she does not overrate the rôle of this logic of the unconscious in mundane affairs. It is more than doubtful whether at man's present state of evolution reason can bring about the progress that some of its votaries—Mr Wells, for instance—contemplate as a near possibility. Our personal judgments and convictions are often most deeply tinged with fallacy—at least with logical fallacy—just where we believe them most to be founded on pure reason, and to realise how fundamentally beliefs depend on emotional, unconscious bias and wish, seems the readiest means of delaying hasty action which may, after all, turn out to be wrong. The logic of the unconscious mind, indeed, if its lessons be read aright, preaches a gospel of humility of personal opinion, which the die-hards of all parties and other pundits of like kidney might well take to heart.

Dermatology: The Essentials of Cutaneous Medicine. By WALTER JAMES HIGHMAN, M.D., Associate Professor of Dermatology, New York Post Graduate School and Hospital. Pp. 454, with 95 illustrations. New York: The Macmillan Company. Price 32s. net.

An interesting book written in a needlessly aggressive style. On the outside paper appears a notice that it has been written from the standpoint that the dermatologist "is an internist who knows the skin." The preface begins with the statement that "works on dermatology usually ignore the teaching needs of beginners—this volume aims to present essentials succinctly, consecutively, completely, and simply." In the opening chapter on Etiology the references to Hebra and Kaposi are in questionable taste (almost anti-Semitic). Can it be said truly that "Hebra lived in a day in which the study of micro-organisms was engaging the world, and in which they were being held accountable for all diseases."

New Books

Hebra was appointed Professor in Vienna in 1849, and his book was published in 1860, and the English translation in 1866-74. On page 186, "although the average text-book discusses these points the matter is too absurd for consideration." Tuberculin treatment of lupus vulgaris, a method which has found favour with many with far greater experience than Dr Highman, is dismissed in four words, "tuberculin injections are useless." Later we are told that in erythema induratum, which he recognises as a tuberculous disease, they are useful. But in spite of these youthful excesses, a good many mistakes in spelling, and evidence that the paper famine has at last reached America, the book contains a great deal of interesting matter, and the expert will read it with benefit and not a little amusement. The 95 reproductions of photographs are on plate paper, and many of them are excellent.

Practical Preventive Medicine. By MARK T. BOYD, M.C., C.P.H.
Pp. 336, with 135 illustrations. Philadelphia and London:
W. B. Saunders Company. 1920. Price 20s. net.

In many directions our American friends are forging ahead, and in no sphere are they making more rapid and graphic progress than in Preventive Medicine. They believe in hustle, and are not afraid to employ what are vulgarly called "stunts" to bring facts before their public. Everyone values and appreciates Rosenau's books on Public Health. Dr Boyd does not conceal the fact that the present volume follows the footsteps of Dr Rosenau's labours. But Dr Boyd has given us a very well-written condensation of a very wide subject. It never irritates the reader with a sense of undue brevity, and where the information seems cursory the author has given his reader many references for acquiring fuller knowledge. As one might expect from America, where they are concentrating upon hygienic milk supplies, that side of the subject is well treated. Occupational and other diseases are discussed in a manner not commonly found in present-day works. We heartily commend the volume as a reliable and readable one.

NOTES ON BOOKS

Mr Ferguson's *Thyrea and Other Sonnets* (Andrew Melrose, 1920, 1s. net), written as they are by a patient about his experiences in a sanatorium, inevitably challenges comparison with Mr Henley's verses on the Old Edinburgh Infirmary. "Thyrea" lacks the poignancy and pictorial quality of "In hospital," and the sonnet form is less tractable than the unrhymed rhythms which Mr Yeats (it is said) told Henley were not poetry. It is always difficult, and seldom fair, to give samples of the quality of a sonnet by an extract, but we may be allowed to quote a few lines from two:—

"They do not like us dying here, we know,
They talk about the credit of the place—
The Doctor when he sounded me to-day,
Said never a word about last night ; and lo,
Her custom'd smile lights up the Nurse's face."

and this, the opening lines of the sonnet on "Chopin's Funeral March":—

"The pulse of grief beats through these quivering strains,
And the all-conscious keys are fraught with drear
And wizard echoes from those shadow plains
Where mortals journey, and return not here."

There is some real poetry in Mr Ferguson's little volume.

The hypothesis that Achondroplasia is due to amniotic pressure was promulgated some years ago by Dr Murk Jansen, who now in *Feebleness of Growth and Congenital Dwarfism* (London: Henry Frowde and Hodder & Stoughton, 1921, 12s. 6d. net) extends his theory to explain mongolism, cleido-cranial dysostosis, congenital dislocation of the hip, and other malformations. He also discusses feebleness of growth in general, seeking to find some common factor for slight muscular and skeletal retardation on the one hand, "static" deformities like knock-knee, and the severest type of rickets on the other. How far his ingenious arguments will carry conviction is doubtful, but apart from the theory there is a great deal of accurate clinical observation in this well-illustrated book, to which Sir Robert Jones has contributed a preface, acknowledging the debt which Britons interned in Holland during the war owe to the sympathetic kindness of Dr Jansen.

Letters to a Nurse by a Midland doctor (London: Bale, Sons & Danielsson, 1921, 5s. net) is a diverting and sensible series of letters purporting to come from an uncle to a niece who has begun her

Notes on Books

nursing career. They contain a great deal of shrewd common sense about medicine, hospitals, nurses, doctors, and life in general, and if their precepts were followed more generally all concerned would benefit.

Dr John Henderson's *Medicine for Nurses* (London: Edward Arnold, 1921, 8s. 6d. net) is a short, practical outline of clinical and practical medicine which is well adapted for the use of nurses. It is sufficiently full, and is simply written, and ought to prove useful.

The changes in the second edition of *Graphic Methods in Heart Disease*, by John Hay, M.D., F.R.C.P. (Henry Frowde and Hodder & Stoughton, 12s 6d. net), reflect some of the advances which have been made in our knowledge of the heart's mechanism and its disorders since the publication of the first edition eleven years ago.

Auricular fibrillation is described, its association with complete arrhythmia of the pulse explained, and the beneficial effect of digitalis in this condition pointed out. Auricular flutter and the various forms of paroxysmal tachycardia are also dealt with. A chapter is added in which the electro-cardiograph is described and a series of typical electro-cardiograms analysed. The numerous polygraph records are well chosen and clearly reproduced. While incorporating new matter, the book retains the features which previously made it so useful a guide to the employment of graphic methods in the study of heart disease.

The fifth edition of Lewis's *Clinical Disorders of the Heart Beat* (London: Shaw & Sons, 1920) has undergone a certain amount of revision, chiefly in the omission of some of the tables. It remains a thoroughly useful handbook on a very important subject.

The fourteenth edition of Professor Anders' *Practice of Medicine*, prepared with the assistance of Dr John H. Musser, jun. (W. B. Saunders Company), has been brought thoroughly up to date, and contains an account of all recent methods and advances up to the time of its publication. All that was learnt of medical matters during the war has been included, and many of the most important sections have been completely rewritten in the light of recent research. Diseases of everyday importance are dealt with in great detail, while rarer conditions are sufficiently described for practical purposes. Many useful diagnostic tables are included, while the value of the book is enhanced by footnote references to important original articles. The illustrations are of practical utility, and are uniformly well produced. The work must be regarded as one of the most complete and useful American text-books of the day, and can be unreservedly commended.

Notes on Books

The Clinical Examination of Diseases of the Lungs by E. M. Brockbank and A. Ramsbottom (H. K. Lewis & Co., 4s. 6d.), is intended to help students to understand the physical signs of pulmonary disease. It would have been more likely to attain this object if the text had been more carefully revised before publication. As it is, many of the sentences are so involved and inexplicit as to be practically unintelligible, and of these few can stand the test of grammatical analysis. The omission of essential punctuation marks is several times responsible for absolute nonsense. The book should be revised and rewritten throughout. We do not think the authors have done themselves justice in issuing it in its present state.

Blood Pictures, by Cecil Price-Jones, second edition (John Wright & Sons, 6s. 6d. net), is intended to aid clinicians in the interpretation of reports on the examination of the blood, and no doubt it serves its purpose. A book so short is necessarily dogmatic, and the reader who depends on this volume alone might assume that the author's views are generally accepted. In many instances this is not the case. Many of the appearances figured in the five coloured plates are artefacts, and the "phylogenetic diagram" of blood cells may be regarded as original if not fantastic.

BOOKS RECEIVED

BROWNE, EDWARD G. <i>Arabian Medicine. Fitzpatrick Lectures. 1919-1920</i>	(Cambridge University Press)	12s.
CHEATLE, ARTHUR H. <i>Catalogue and Guide to Collection of Lantern Slides demonstrating the Surgical Anatomy of the Temporal Bone. Set of 200 with photographs and Catalogue</i> (H. K. Lewis & Co., Ltd.)		£30
KARSNER, HOWARD T., and ECKER, E. ENRIQUE. <i>The Principles of Immunology</i>	(J. B. Lippincott Company)	21s.
KEITH, ARTHUR. <i>Human Embryology and Morphology. Fourth Edition</i> (Edward Arnold)		30s.
MOYNIHAN, Sir BERKELEY. <i>The Spleen and some of its Diseases</i> (John Wright & Sons, Ltd.)		21s.
PLIMMER, R. H. A. <i>Analyses and Energy Values of Foods</i> (H.M. Stationery Office)		6s.
ROBERTSON, W. G. AITCHISON. <i>Medical Conduct and Practice</i> (A. & C. Black, Ltd.)		6s.
ROBERTSON W., and PORTER, CHARLES. <i>Sanitary Law and Practice. Fifth Edition</i>	(The Sanitary Publishing Co., Ltd.)	18s. 6d.
THOMSON, H. HYSLOP. <i>Tuberculosis: its Prevention and Home Treatment. Second Edition</i>	(Oxford Medical Publications)	4s.
WHITNALL, S. ERNEST. <i>The Anatomy of the Human Orbit and Accessory Organs of Vision</i>	(Oxford Medical Publications)	35s.

Edinburgh Medical Journal

September 1921

SUBACUTE BACTERIAL ENDOCARDITIS.

By FRANCIS D. BOYD, M.D., Professor of Clinical Medicine,
University, Edinburgh.

SUBACUTE bacterial endocarditis is now a well-known clinical entity which, in this country, was first brought prominently under notice by Sir William Osler in his *Goulstonian Lectures* in 1885. In this paper will be found references to earlier observations by Wolfs, Bristo, and Coupland. Following a later paper, in 1907, by Osler, there appeared an important contribution by Horder. An extensive study of the disease has been made by Libman of New York, who has made several important communications on the subject. In 1917 Latour published a monograph from which it is evident that the disease had been known to French observers for a long time, while some of the observations of Rapin go back as far as 1871. The condition usually begins insidiously—rarely acutely with a chill. There is malaise, debility, loss of tone, and it is only when it is fully established that a definite cardiac lesion may be discovered. The character of the fever is intermittent or remittent. In some cases chills occur at irregular intervals, and are often accompanied by profuse sweating, but frequently the sweating occurs without the chill. The blood shows progressive anæmia of a secondary type. Leucocytosis may be marked, but in some cases the leucocyte count may be practically normal. Emboli and infarctions are a constant feature of the disease. Attacks of abdominal pain are frequent. Not infrequently there is complaint of joint pain and distinct peri-articular swelling, but, as a rule, the joint affections are milder than those of acute rheumatism. The disease frequently occurs in individuals who have had a previous valvular lesion. This may not always be the case, but eventually organic murmurs develop. As a rule the rhythm remains normal, the myocardium being little affected. Yet cardiac phenomena may not be a prominent feature.

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Hudson records a case where the patient was never really "cardiac." There was no dyspnœa or œdema, and the pulse maintained a steady, regular, slow beat to the end. The patient was in a typhoid state throughout the disease, and died eventually of slow toxæmia.

CASE I.—A boy, aged 13, was admitted to Ward 34 from Dr Guthrie's School. He complained of palpitation, shortness of breath, stiffness of the legs, and had been ailing, according to his own account, for about a fortnight. The patient had apparently been perfectly well up till a month before admission when he developed a sore throat and was in the school hospital for a fortnight. Before discharge from the school hospital he noticed indefinite pains about the body. They occurred in the joints and muscles but the joints showed no swelling. They appear to have simply been the indefinite pains which occur so frequently in a subacute infective condition. The patient began to be conscious of his heart beating frequently, of breathlessness, and very rapid breathing. He had faint turns whilst still confined to bed. He had a cough which was worst at night, but there was no sputum. There were occasional attacks of night sweating. The previous health appears to have been good, save that at the age of nine he had suffered from chorea, which lasted for twelve months.

On examination, he was found to be a very intelligent child who took a deep interest in his own symptoms. Well developed for his age, he showed marked pallor and a certain degree of cyanosis of the lips and ears. The temperature was irregular, mostly rising at night—a four-hourly chart bringing out the point that though the temperature might be normal at seven o'clock, earlier in the afternoon it was elevated. When feverish the patient showed pronounced sweating but there were no definite rigors. The fingers showed clubbing. The heart showed a very definite organic mitral lesion and was markedly enlarged. The liver was enormously enlarged and free fluid was present in the abdomen. There was anæmia and a definite leucocytosis, at one time reaching 19,000. A differential count showed:—Polymorphs, 79 per cent.; small lymphocytes, 13 per cent.; large lymphocytes, 8 per cent. The spleen was enlarged and palpable below the costal margin. Dr Logan examined the blood bacteriologically, with negative results. The urine showed the presence of albumin but no blood. Under rest and careful nursing the patient improved slightly, but every few weeks he would have a fresh rise of temperature and be thrown back. On one of these occasions he developed a thrombosis of the external jugular vein on the left side. Abdominal pains, with sickness and vomiting, were of somewhat frequent occurrence. The first attack was so severe that surgical

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advice was sought as to whether or no it were an acute abdominal condition necessitating operation.

A prominent feature of subacute bacterial endocarditis is the occurrence of emboli which may give rise to a minute embolic infarction occurring in the skin as ephemeral spots of painful nodular erythema, or as petechiæ, frequently occurring in showers scattered over the chest and thighs.

CASE II.—For example, a man, aged 45, was admitted to Ward 34, complaining of swelling of the ankles, spots of blood under the skin, and weakness. His history was that twenty years previously he had suffered from rheumatic fever. In March 1919 the patient had an attack of influenza and was confined to bed for three weeks. When he was able to be about he noticed that his ankles began to swell and that small spots appeared on his legs below the knee. He began to suffer from marked orthopnoea at night and often felt faint. He sought admission to the Infirmary for treatment. The heart was found to be markedly enlarged and there were signs of aortic and mitral valvular disease. He was anæmic and the spleen was enlarged. There was a considerable number of small petechial spots on the legs below the knee. The temperature was irregular. During the course of his illness he developed very marked painful, erythematous nodules on the legs, and during the last week there was a pronounced outcrop of minute petechial spots over the abdomen and trunk.

Emboli may involve an arterial branch of considerable size or a cerebral artery, giving rise to very grave results. The following case well illustrates this point.

CASE III.—A young man of 24 was admitted to Ward 34 on 22nd April 1920. Up till May 1917 the patient had been perfectly well to all appearance when, during a long cycle ride on service in France, he collapsed. He was taken to hospital in France and evacuated to England, suffering from valvular disease of the heart. Until this time he had always been graded A1 and had served in the Cycle Corps. In February 1918 he was discharged from the army and returned to work. At this time he was feeling fairly well and could carry out his work without discomfort. In June 1919 he commenced to suffer from pain in the ankles and was off work till December. There was no history of rheumatic fever. He had occasionally suffered from sore throat. The patient was a well-developed, muscular young man, somewhat pale and anæmic-looking, but there were no other obvious morbid appearances. The temperature was rising at night. There was complaint of palpitation and breathlessness on exertion. He

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stated that he could walk six miles without discomfort, but that any running made him feel breathless.

On examination, the pulse was found to be regular in time and force—frequency 120 per minute. There was a very marked double mitral lesion and aortic regurgitation. The spleen was enlarged, the blood showed some anæmia, and there was a mild leucocytosis. Blood cultures were negative. On 22nd May patient complained of a numb, cold feeling in his right hand, which continued all day. There was pain and tenderness over the brachial artery at the junction of the middle and lower third of the arm. There was no pulse to be felt in the right wrist either in the radial or ulnar vessel. Above the situation of the pain the brachial pulse was palpable. The pain in the upper arm was intense, necessitating the administration of morphia. After the lapse of a week the right hand became as warm as the left and a slight arterial pulse was palpable. Progress was apparently good, but there were occasional rises of temperature. He gained in weight but he was very nervous about himself and one night he became very excited and stated he felt he was going to die. Under treatment this nervous attack passed off and he appeared to improve rapidly, complaining of no symptoms whatsoever. One afternoon, however, he appeared to be rather drowsy and complained of a sharp, stinging pain in the right temporal region, and there was hyperæsthesia of that side of the skull. He vomited and the pulse frequency rose. The left arm became completely paralysed and there was a suggestion of external strabismus and the face was drawn slightly over to the right. The patient became comatosed, with laboured respiration, and died the following morning. Post mortem, the cardiac valves on the left side showed masses of vegetations, the vegetations spreading from the valves to the endocardium. The spleen showed numerous infarcts. The brain showed a massive hæmorrhage rupturing into the ventricle. Here embolism had led to the formation of a cerebral aneurism, to giving way of the vessel at the weak point, and massive hæmorrhage.

The prognosis in subacute bacterial endocarditis is always grave. As a rule, the patient seldom survives more than a year.

CASE IV.—A candidate at a recent final examination looked obviously ill and complained of pains throughout the body. There was no swelling of the joints. I saw him subsequently, with Dr Murray Wood. The history was that he had had endocarditis some years previously, which had left a permanent cardiac lesion which had led to his being rejected for army service. He was finally accepted, however, in the Naval Volunteer Reserve and did very good work at Zeebrugge. When seen he was gravely ill, the temperature rising at night. There was an aortic and mitral lesion. The spleen was

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enlarged. Dr Logan took a blood culture and was able to isolate a streptococcus. Under treatment some small improvement took place but death occurred two months after his appearance at the examination.

Yet the prognosis is not always bad. Libman of New York, out of between three and four hundred cases, records the recovery of three. It is interesting to note, if recovery does take place, how complete it may be. Some years ago I saw a young officer suffering from subacute bacterial endocarditis. The heart was enlarged and there were murmurs audible at every area. The prognosis seemed thoroughly bad, but under prolonged rest and careful nursing the temperature fell and the symptoms and signs completely disappeared. So complete was recovery that a year after joining up he won a cross-country championship.

Subacute bacterial endocarditis is most frequently found in patients who have suffered at some previous period of their career from an organic valvular lesion. It has been the fashion lately to teach that an organic mitral lesion is of little or no consequence as long as the myocardium is healthy. One would like to enter a protest. This teaching seems to have been carried to an extreme, especially during the war. We saw the unfortunate effects of this teaching in the Army in Egypt and Palestine. A man had a valvular lesion—Egypt was a fine climate—he was drafted to Egypt. Now Egypt and Palestine are typically septic countries. Under the strain of a campaign, deteriorated health, and some infective disease such as tonsillitis or boils, a streptococcus gained an entrance into the circulation, settled down on the damaged valve, and infective endocarditis resulted, with a fatal termination. In a considerable proportion of the cases cocci will be found in the blood culture. These cocci have been named *Streptococcus viridans* or *mitis* by Schottmüller, *Streptococcus salivarius* by Horder. Occasionally the influenza bacillus may be found (Malloch and Rhea). The finding of streptococci in the blood justifies an unfavourable prognosis, for, as a rule, the case goes on to a fatal termination. Yet you do not always get a positive result from blood cultures. Libman distinguishes three different stages of the disease—the bacterial, the bacteria-free, and the healing. Blood cultures may be negative because the micro-organisms may be adhering to the vegetations on the cusps and not circulating in the blood stream, and, as a

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consequence, bacteriological examination of the blood may be negative. Or it is possible that although micro-organisms were at one time present in the general blood-stream, they were not present at the time when the blood was taken for examination.

The treatment of subacute bacterial endocarditis is very unsatisfactory. Obviously complete rest in bed is indicated. If an organism is isolated from the blood it is one's duty to undertake a course of vaccine treatment, but too much faith must not be pinned to this form of treatment, for, as a rule, the results are not striking. Medicinal substances given by the mouth seem to have little or no influence on the course of the disease. At one time one had great hopes of the possibility of sterilising the individual, but these hopes have not been fulfilled, and it must be remembered that this form of treatment is not free from risks, in endocarditis. For example, a patient was admitted to Ward 34 in March 1920. Three weeks previous to admission he had had a cold, cough, hoarseness, and pain in the small of the back. He stated that he had always been a healthy man and there was no history of rheumatic fever. On examination it was found that he was running an irregular temperature and that the heart was markedly enlarged. There was an aortic and mitral valvular lesion, the fingers showed clubbing, the spleen was enlarged, and the blood showed a leucocytosis. A blood culture was carried out and a streptococcus isolated in pure culture. We tried to sterilise the patient. Under the most careful precautions 60 c.c. of Eusol solution were administered intravenously. The patient began to complain of pain and contraction in the chest. He became unconscious and it took an hour to resuscitate him. As the illness progressed improvement appeared to take place and he was able to be up, but one day he collapsed and died very suddenly. Abrahams gives an account of the treatment of streptococcal endocarditis with auto-serum injections. A patient was treated with three injections of 20 c.c. of her own serum on three consecutive days. With the beginning of the auto-serum injections the condition appeared to improve. Improvement was continuous until she was discharged at the end of three weeks, apparently completely cured. One has had no personal experience of the treatment, but in view of the otherwise hopeless outlook in these cases, it at least seems worth trying.

Subacute Bacterial Endocarditis

REFERENCES.—Osler, *Brit. Med. Journ.*, London, 1885, vol. i., p. 467 ; *Quart. Journ. of Med.*, Oxford, 1909, vol. ii., p. 219. Horder, *Quart. Journ. of Med.*, Oxford, 1909, vol. ii., p. 289 ; *Brit. Med. Journ.*, London, 28th August 1920, p. 302. Hudson, *Brit. Med. Journ.*, London, 1918, vol. ii., p. 512. Starling, *Ibid.*, pp. 154-157. Libman, *Tr. Internat. Cong. Med.*, 1913, London, 1914, Sect. VI., Medicine, part ii., pp. 195, 211 ; *Brit. Med. Journ.*, London, 28th August 1920, p. 304. Malloch and Rhea, *Quart. Journ. of Med.*, Oxford, 1918-19, vol. xii., pp. 174-82. Abrahams, *New York Med. Journ.*, 1914, p. 1216. Carey Coombs, *Brit. Med. Journ.*, London, 1920, vol. ii., p. 306. Gow, *Ibid.*, p. 307. Gibson, *Ibid.*, p. 308.

THE PITUITARY GLAND IN CHILDREN.

VARIATIONS IN ITS PHYSIOLOGICAL ACTIVITY, WITH SPECIAL REFERENCE TO THE CONDITION OF THE "PITUITARY LAKE."

By JOHN FRASER, M.D., F.R.C.S.

IT has been a common experience that in pursuing some definite line of research work one is led into side issues which, though quite distinct from the original idea, offer possibilities of absorbing interest. An experience of this description has been responsible for the production of the present paper.

The position is somewhat as follows:—In following out various lines of thought in connection with the effect of ductless gland secretion on ossification, I was led to investigate the pituitary gland as it exists in children of various ages. While generally interested in the histological appearances of the gland, I was especially attracted by the condition of the so-called "pituitary lake." I observed the various manifestations of which this structure was capable, manifestations which varied from a mere slit between the two lobes of the pituitary to a cystic distention which, in view of the comparative size of the complete gland, may be fairly described as considerable.

On comparing the pituitary of the child with that of the adult, I found that the variation in the size of the pituitary lake was apparently a feature distinctive to the child, or at least to the period between birth and adolescence. The recognition of this fact led me to investigate in further detail the condition of the child's pituitary, primarily with a view to explaining the wide variability in size of the pituitary lake in the early years of life. A brief account of the investigation and the consideration of certain explanations and hypotheses are detailed in the following communication.

The Anatomy of the Gland.—To make the paper sufficiently comprehensive it is necessary to detail certain anatomical points, though these, of course, are well enough known to require no elaboration.

The main pituitary lies within the compass of the Sella Turcica, and there are three small extra sellar portions—the pharyngeal pituitary, which runs upwards and backwards behind the vomer; a portion of the anterior lobe, which partly surrounds the neck of the gland and extends for a short distance over the

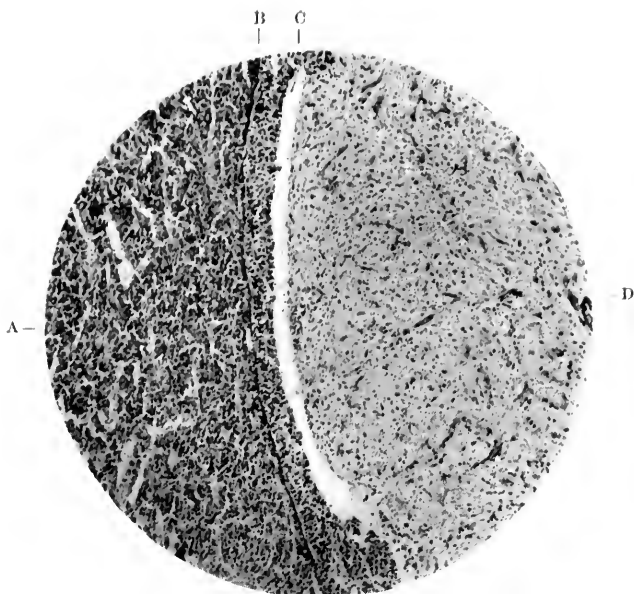


FIG. 1.

The appearance in the adult of the pituitary lake and its surroundings.
 × 6 diam.

A—Anterior lobe.
 B—Pars intermedia.

C—Pituitary lake.
 D—Posterior lobe.

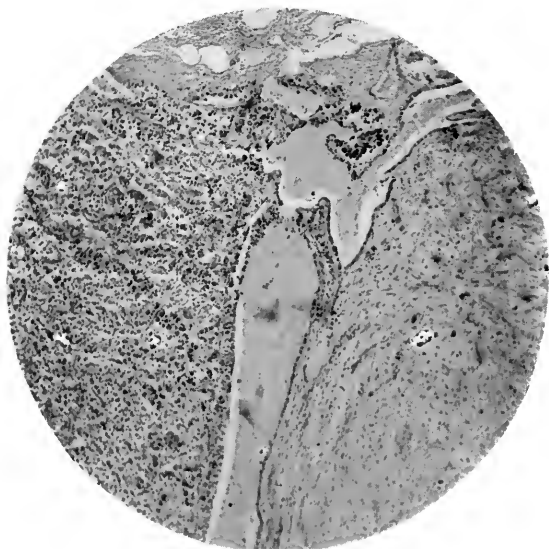


FIG. 2.

The pituitary of a male child aged 3 years. The gland is in a resting stage; the pars intermedia is represented by a single layer of cubical epithelium. × 50 diam.



The Pituitary Gland in Children

base of the brain ; and the infundibulum or neck portion, which connects the posterior lobe with the nerve tissues at the base of the brain.

In the well-developed organ the pituitary consists of three portions—the anterior lobe, the posterior lobe, and the pars intermedia.

The anterior lobe has the structure of a secretory gland. There is a branching network of epithelial cells with numerous blood-vessels, the cells are chromophilic and chromophobic, the former are of two types (the acidophilic and the basophilic), there are a certain number of cells of an indifferent staining reaction (Hauptzellen). Between the anterior lobe and the pars intermedia there is a cavity, the pituitary lake—or, as it is sometimes called, Kolliker's space.

The pars intermedia occupies the space between the posterior wall of the pituitary lake and the anterior wall of the posterior lobe. It has a distinct similarity in structure to the anterior lobe, but the cells are smaller and less distinctly granular, while the blood-vessels are fewer. The cells which border upon the pituitary lake are generally arranged somewhat like a layer of *columnar* epithelium.

The posterior lobe is comprised of simple neuroglial tissue with blood-vessels; occasionally granular cells, basophilic more commonly than acidophilic, are found scattered through the glial tissue.

The Development of the Gland.—Developmentally the pituitary body has a double origin. From the dorsal wall of the stomodæum an upward evagination of the epithelium occurs, known as Rathke's pouch. Corresponding to this there is a downgrowth from the floor of the fore-brain, known as the hypophysis, which comes into close connection with the back of Rathke's pouch. The hypophysis becomes the posterior lobe of the pituitary body. It forms a solid mass, and remains connected with the brain by means of a stalk (the infundibulum), and a funnel-shaped, dilated attachment (the tuber cinereum). Rathke's pouch is detached from the oral epithelium, becomes vesicular, and is converted into the anterior lobe of the pituitary body. The pituitary lake is probably the remains of the cavity which originally existed within Rathke's pouch.

The Morphology of the Pituitary Gland.—The morphological significance of the pituitary body has given rise to much discussion. John Goodsir was the first to suggest that the

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connection between the mouth and the vesicular system of the brain might be of the nature of an ancestral œsophagus—a hypothesis which has been revived and elaborated by Gaskill in his investigations on the evolution of vertebrate from invertebrate forms. Different morphological types are seen in the cat, in the dog, and in man. In the cat the posterior lobe is hollow, and the hollow communicates with the third ventricle; the anterior lobe contains a large cleft, and there is a well-defined *pars intermedia*. The posterior lobe is embraced to a considerable extent by the anterior lobe—in fact the infundibulum is entirely surrounded by the latter. In the dog the communication between the third ventricle and the posterior lobe is incomplete—the infundibulum portion of the gland is hollow, the remainder is solid. The anterior lobe contains a well-developed cleft, and there is distinct embracement of the posterior lobe by the anterior. There is a well-marked *pars intermedia*. In man the posterior lobe is solid throughout, and all trace of communication with the ventricular system has been lost. There is a cleft in the anterior lobe. The anterior lobe does not extend to any degree around the posterior lobe. The *pars intermedia* is uniformly well developed. This general description holds good for the ox, the pig, and the monkey.

The Physiology of the Gland.—Our knowledge of the physiology of the gland may be summarised as follows:—The extract of the posterior lobe raises the blood pressure, dilates the pupil, causes diuresis, and, when administered over a long period, gives rise to nutritional disturbances: extract of the anterior lobe stimulates growth, and, if administered in cases of hypopituitarism, produces pyrexia.

THE MATERIAL EMPLOYED IN THIS INVESTIGATION AND THE METHOD OF EXAMINATION.

A series of forty pituitary glands obtained from children between the ages of one year and twelve years has been made the subject of the examination.

In the cases first examined the glands were removed from the pituitary fossa. It was found that this procedure often involved damage to the gland, and especially to the infundibular portion. In the later cases, therefore, the *Sella Turcica* was removed with the gland *in situ*, and a portion of the floor of the third ventricle was retained attached. The surrounding

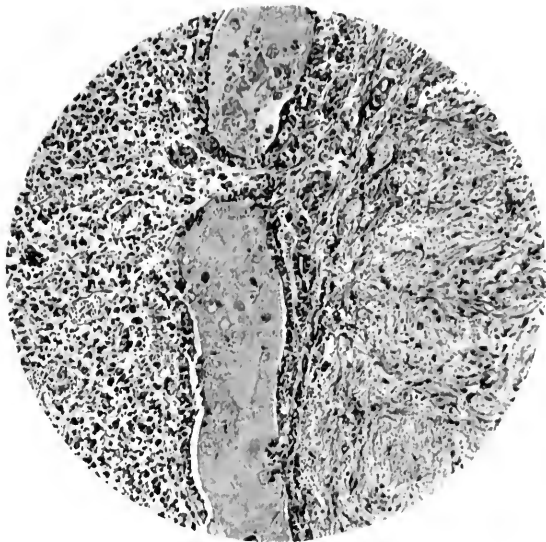


FIG. 3.

The pituitary of a male child aged $2\frac{1}{2}$ years. The gland is entering on its active stage. The vascularity of the gland is increasing; there is an eosinophilic tide in the anterior lobe; the pars intermedia is undergoing proliferation; there is an increasing accumulation of contents in the pituitary lake. $\times 60$ diam.

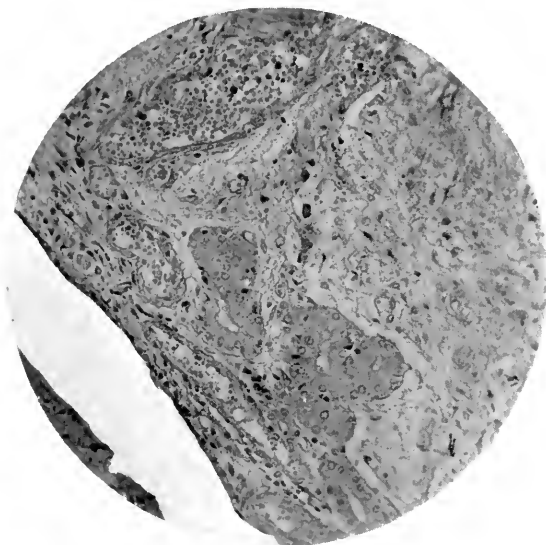


FIG. 6.

This section illustrates the collection of acinar tissue which is so constantly found at the junction of pars intermedia and posterior lobe. $\times 150$ diam.



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bony tissue was decalcified in Perenny's fluid, and the complete section was embedded and cut in celloidin.

The structure of the anterior lobe was differentiated with eosin and methylene blue—with Jenner and with Leishman; sections stained with iron hæmatoxylin demonstrated the characters of the neutral cells (Hauptzellen).

To bring out the structure of the posterior lobe Golgi's method or Cox's modification of Golgi's method was used. The majority of the glands were cut in sagittal section, a few were demonstrated in coronal section.

In view of the fact that it might be possible to demonstrate relationships between histological characters and clinical conditions, case histories were detailed.

A General Account of the Results of the Investigation.—

While not appearing to prejudge the investigation at this stage, I may so reverse the logical sequence as to state now that the results have been such as to convince me that in children the pituitary gland has distinct periods of activity and rest. The observations to substantiate such a view will be recorded later. After a careful perusal of the literature available, I cannot find that such a view has yet been put forward by the physiologist, and it is with great diffidence that I express it. None the less, I am convinced of the correctness of the observation, and it occurs to me that it may be a matter of considerable practical importance.

I will recount the evidence of a glandular cycle under the headings of: Changes in the Pars Intermedia—in the Pituitary Lake—in the Anterior Lobe—in the Vascularity of the Gland.

A. The Changes in the Pars Intermedia.—Histological examination has demonstrated that the pars intermedia in the child is in a very different condition to that which one recognises in the adult pituitary. I quote the following description of the pars intermedia as given in the *Text-book of Microscopic Anatomy* (Quain : Schäfer):—

“In the pars intermedia the cells are smaller and less distinctly granular—at least the granules are finer—and blood-vessels are far fewer. The cells are massed against the posterior boundary of the intra-glandular cleft: the layer next to the cleft is arranged somewhat like a columnar epithelium. The opposite or anterior wall of the cleft is bounded by flattened cells. The

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most characteristic feature in the structure of the pars intermedia is the presence of globules of a material to which the designation of colloid has been given."

This description certainly cannot be accepted as being uniformly applicable to the pituitary gland in children. I take it that the pars intermedia of the physiologist and the histo-pathologist may be defined as the portion of the gland which lies between the nervous tissue of the posterior lobe and the intra-glandular cleft or pituitary lake. In children, as far as I have been able to discover, the tissue arrangements in this particular region may be grouped in one of two ways:—

- (1) There is a single layer of cubical epithelium which lies in contact with the cleft; deeper, there is a thin layer of fibrillar tissue carrying blood-vessels, and among the fibrillar tissue there may be groups of cubical cells similar to those which lie on the surface.
- (2) The space may be occupied by a zone of rounded, finely granular cells: the zone may be ten or twelve cells in depth, the numbers varying considerably in different parts. There is no trace of a distinct limiting band of cubical epithelium, such as exists in type (1).

The distinction between the two types is striking, and it would seem to me that the explanation of the difference is that the two types represent varying physiological conditions of the gland. Type 1 illustrates the pars intermedia in its "resting" stage; type 2 represents the same tissue in its "active" stage. Such a conclusion appears to me to be a very reasonable one. There is clearly no pathological bearing in the change, and it has been demonstrable because a large number of pituitaries have been examined. It is conceivable that, if the examination had been confined to one or two glands, such a variation might easily have been overlooked. I have examined a number of adult pituitaries, but in these I have been unable to discover any corresponding cycle of changes—the appearance has been uniform, and the description quoted above from Quain's *Anatomy* is sufficiently descriptive of it.

Up to this point I have purposely avoided any reference to the collection of acinar-like cells, which are found generally in the line of junction between the pars intermedia and the posterior lobe. They do not appear to share in the changes



FIG. 4.

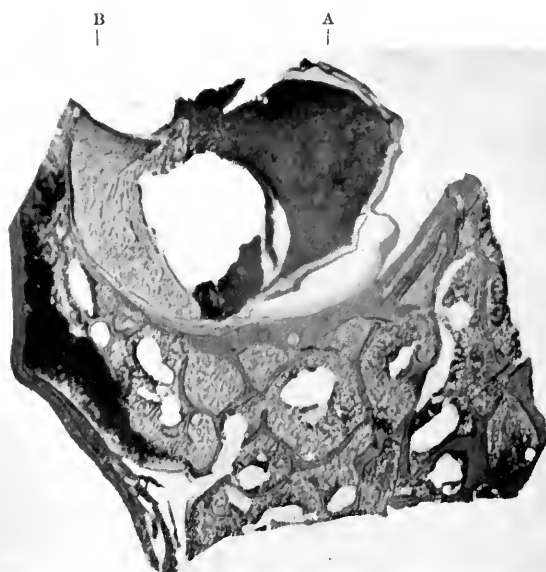


FIG. 5.

Appearances illustrative of the active stages of the pituitary gland as observed in children aged respectively 3 years and 6 years.

Note the intense eosinophilic reaction of the anterior lobes, and the distention of the pituitary lakes. A—Anterior, B—Posterior. In Fig. 5 the position of the section has been reversed. $\times 6$ diam.

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which the pars intermedia undergoes, and in many specimens I have been unable to discover any trace of their existence. It is possible that these cells are relics of the original invagination from the stomodæum—cells which have not adapted themselves to the cytological changes which have resulted in the formation of the anterior lobe.

I may summarise the examination of the pars intermedia, therefore, by stating that during the period between birth and adolescence the tissue passes through a cycle of changes which may be described as "resting" and "active."

Further evidence in favour of this view will be put forward:—

B. *The Changes in the Pituitary Lake.*—I have employed the term "pituitary lake," but there are other synonyms—it is spoken of as the intra-glandular cleft or fissure, and Kolliker's space. Embryologically, it is the persistence of the interior of Rathke's pouch. Anatomically, it separates the pars intermedia from the anterior lobe, and its distribution is greater than is commonly supposed. This wide extent in distribution is well brought out by sectioning the gland in various planes. Clinically, it has aroused interest because its capacity undergoes a remarkable variation; it may exist as a practically empty slit, it may show a moderate accumulation of colloid material, it may undergo a distention so great as to occupy a third or even more of the total bulk of the gland.

From the examination of a large number of specimens it would appear that the capacity of the pituitary lake is closely related to the condition of the pars intermedia, for it has been found that when the pars intermedia is in an active state (type 2), the pituitary lake is distended with content, while a pars intermedia in a resting state (type 1) is accompanied by a slit-like and empty lake. While the pars intermedia is in a resting state the lake is small, and in certain cases practically empty. As the pars intermedia becomes more active, secretion begins to accumulate within the lake until it becomes distended to a considerable degree. The pars intermedia then returns to its resting state, and though the distention of the lake may continue for some time after the active condition of the pars intermedia has passed, its capacity gradually diminishes, and it returns again to a slit-like space.

Such a view as I have expressed presupposes that the pars intermedia is the source of the formation of at least part of the

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contents of the pituitary lake. There is definite evidence that the lake contents are produced from two sources. The homogeneous colloid material is formed from the pars intermedia, and as such it constitutes by far the larger portion of the contents, but there is a secondary source of supply from the anterior lobe, and more exactly from the eosinophilic substances which lie within the larger cells. It is possible to trace the separation of the eosinophilic contents from the cells, and, while much of it is carried away in the blood stream, a certain proportion passes into the pituitary lake, where the rounded globular-like bodies can be recognised before they undergo assimilation in the colloid contents.

C. Changes in the Anterior Lobe.—Apart from the connective tissue framework and the related blood-vessels, there are three special types of cell which are recognised in the structure of the anterior lobe—a large basophilic cell, a large eosinophilic cell, and a small cell with a large nucleus. Speaking in general terms of the numbers of these cells, it can be demonstrated that the tissues of the anterior lobe undergo “tidal changes.” There is a basophilic tide, an eosinophilic tide, and a small-celled tide. Not only so, but it is possible to demonstrate individual waves of the tide, a portion of the gland showing the basophilic reaction, another the eosinophilic reaction, and so on.

The cellular changes which give rise to the tidal changes in the lobe would appear to be as follows: The original cell is a basophilic one. The granular protoplasm undergoes a change, and becomes eosinophilic in reaction. After a time the eosinophilic contents separate from the cell and pass through the cell membrane as a rounded globule. That portion which is left—the comparatively large nucleus with a scanty surrounding cytoplasm—forms the small round cell of the sequence. So the process continues, and the basophilic cell is formed by the re-accumulation in the small round cell of basophilic granules.

The direction of the tidal change is towards the infundibulum and towards the pituitary lake; a certain proportion of the released eosinophilic material is carried away in the blood-vessels as they pass out to the pituitary stalk, while the remainder is discharged into the pituitary lake.

A eosinophilic tide in the anterior lobe is a precursor to the distention of the pituitary lake, for it means that, as the tide progresses, there will result a discharge of eosinophilic material

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into what is none other than the reservoir of the pituitary secretion—the pituitary lake.

We may look at the changes in the anterior lobe in the same way as we have considered those in the pars intermedia—a resting-stage (small cell and basophilic) and an active stage (eosinophilic).

The active stage of the anterior lobe is synchronous with the active stage of the pars intermedia, and is partly preliminary to and partly synchronous with the distention of the pituitary lake.

D. *Changes in the Vascularity of the Gland.*—The changes which I have attempted to outline may be summarised as follows: The pituitary lake acts as the reservoir for the pituitary secretion, and in the adult little demand is made upon it, to act as such, because the blood-vessels are sufficient to cope with the production of secretion which occurs. In the period between birth and adolescence the pituitary gland passes through alternating periods of activity and rest. During the “active” period there is an exaggerated production of gland secretion, with which the blood-vessels of the gland are unable to cope, and, in order to accommodate the temporary period of hypersecretion, the reservoir functions of the pituitary lake are called into play, and it distends with the accumulated secretion.

As the “active” stage subsides and the production of secretion diminishes, the vessels become capable of dealing with the quiescent condition, and the pituitary lake is gradually emptied in preparation for a succeeding cycle.

The active changes in the gland are demonstrated in the pars intermedia, and in the anterior lobe.

Clinical and Practical Bearings.—It is impossible at this stage to discuss with any degree of certainty the reason for and the results of the “physiological tides” which occur in the pituitary gland of the child. One can theorise on widely interesting possibilities, but there is little or no proof in favour of any of them. There are certain statements, however, which may be definitely made:—

1. As a result of the comparison of adult pituitaries with those described in this series, it is believed that the physiological changes described are limited to the period from birth to the end of adolescence. It would, therefore, seem reasonable to assume that the pituitary changes described have some

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relationship to the changes of tissue growth which are so pre-eminent during this period.

2. The changes occur equally in boys and in girls; they therefore have no specific relationship to the female generative organs, though this argument does not exclude an influence on the generative system as a whole. The occurrence of the changes in the earliest years of life, while the sexual characteristics are still largely in abeyance, would seem to suggest, however, that they possess no sexual bearing.

3. The changes have no relationship to any morbid condition. The specimens examined have been obtained from children who have succumbed from widely different types of disease.

4. In view of the fact that it has been proved experimentally that the secretion of the anterior lobe stimulates growth, the idea naturally occurs that the changes described have some relationship to the growth of bone, and more especially to the epiphyseal changes which result in growth in length of the bone.

CLINICAL RECORD

A CASE OF ADENOMA OF THE BILE DUCTS

By D. M. GREIG, F.R.C.S.E., Conservator, Royal College of Surgeons' Museum, Edinburgh.

IN November 1920, while still Senior Surgeon in the Dundee Royal Infirmary, I operated on the patient the subject of the following remarks.

Mrs W. B., aged 44, though occasionally employed as a mill worker, was for the most part engaged in her housework. Her father was drowned at sea, her mother died at the age of 73 of cancer of the "throat" (apparently œsophagus). She had one brother and one sister well, and one sister had died of measles in childhood. Her husband is well, and was occupied during the war as a soldier abroad. She had had eighteen pregnancies. The eldest child is mentally deficient, takes fits and has hemiplegia, the sequence probably of birth injury. In addition, six children are alive and well; two, who were born at full time, died immediately after birth, while another, prematurely born, scarcely survived birth. Three died of measles, at the ages of two and four years and at seven months respectively. After the birth of her youngest child she had four miscarriages, and lastly, a seven months' child, still-born. This is not an indication of any syphilitic taint, but merely the terminal exhaustion of reproductivity.

She had no illness previous to the onset of jaundice in February 1917. The discolouration of the skin and conjunctivæ came on insidiously and without any attack of pain. She had a little discomfort after food, and on occasions a little diarrhœa, but she had never vomited and had felt nothing of the nature of colic. Though easily tired she did not lose flesh, and on examination in January 1918 there was no palpable tumour. There was some itchiness of the skin. The condition suggested rather one of prolonged catarrhal jaundice than of anything more serious. She benefited by a sixteen days' residence in hospital then, but, returning home, thought she lost strength and weight during the subsequent fourteen months, when she was again admitted to hospital.

The Wassermann reaction taken in December 1919 was definitely negative. There was a small marble-sized tumour in the isthmus of the thyroid, probably an adenoma. Her jaundice was very obvious. It did not appear to have diminished at all, but, on the other hand, it had not greatly intensified. Her lips had well retained their colour

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and she was well nourished. Stating that her weakness had increased she maintained she had not lost flesh. What appeared to be the fundus of the gall-bladder was palpable.

The absence of active gastric disturbance seemed to preclude disease of the stomach; nor did the symptoms, even with the very occasional occurrence of diarrhoea, justify a pronouncement of probable duodenal affection. Without anything in the least suggestive of colic, cholelithiasis seemed out of the question. Finally, though the presence of a tumour suggested, the long history and the absence of emaciation and of anæmia seemed to negative, the presence of malignant disease.

Carcinoma of unusually insidious progress causing obstruction to the escape of bile through the common duct seemed, however, the most probable, and the patient was temporarily sent home.

The stools continued, as they had been all along, practically devoid of bile. The urine was dark coloured, though not so dark coloured as one expects to get in complete obstruction of the bile ducts; indeed that, and the unincreasing cutaneous discolouration, suggested that the obstruction was not complete, and though she had some itchiness it was by no means intolerable. I did not agree with her medical attendant's diagnosis of gall-stones, and resisted, though with difficulty, his importunities to operate. I felt that if the conditions were malignant I could only form a fistula by cholecystostomy and her toxæmia scarcely warranted that.

During the subsequent eleven months, that is, until November 1920, I was informed that she had had repeated attacks of gall-stone colic, but when she was re-admitted to hospital she gave no history typical of such occurrences. I was struck, however, on her re-admission, by the extraordinary facts that her jaundice had still not deepened, that her lips still retained a good red colour, and that she was still well-nourished, with a fair quantity of abdominal subcutaneous fat. The tumour continued palpable in the region of the gall-bladder, but had not diminished; and she admitted discomfort, but not pain, in the epigastrium and right hypochondrium, and there was slight tenderness there on palpation. There had been no recurrence of diarrhoea but she was generally constipated, and on no occasion had she had vomiting. She was again quite definite that she had had no spasmodic pain nor pain at all of any severity; a slight heaviness and some discomfort seemed accurately to describe her sensations. It was becoming increasingly difficult to reconcile her condition with the diagnosis of malignant disease.

Operation.—General anæsthesia having been induced by chloroform and ether I did a median supra-umbilical cœliotomy, and on inspecting the parts found the gall-bladder collapsed and the organs about there apparently normal, and there were no adhesions. The palpable tumour

A Case of Adenoma of the Bile Ducts

which had been mistaken for the fundus of the gall-bladder, was a cystic swelling which bulged behind the peritoneum above the pancreas, and pressed on the cystic and common bile ducts. It was slightly movable and did not suggest a pancreatic cyst, either in position or size, and there was no impacted or other gall-stone to be felt. The area around being shut off by swabs, I incised the cyst and evacuated a considerable quantity of viscous bile-coloured fluid, and then, on examining the parts no other tumour could be felt. The cyst wall was strong and thick, and the fingers passed as far as possible round the limits of the cyst before it was opened, did not suggest deep-seated posterior attachment. I thought for a moment it might be a pancreatic cyst, but the contents were not of the grass-green colour associated with that condition and obviously much more like bile. No communication, however, could be made out between the cyst wall and the biliary passages, and after the cyst was swabbed dry there was no continuing leakage of bile.

Visual examination showed that the cyst wall was covered with curiously symmetrical cystic elevations, each about the size of a small bean. A number of these were pricked and each exuded a drop or two of bile-stained viscous fluid similar to that of the large cyst. A portion of the cyst was removed for examination, a drainage tube passed through a convenient portion of the abdominal wall was left *in situ*, and the coeliotomy wound closed.

A good deal of discomfort followed during the subsequent four days, and though the temperature remained subnormal the patient's pulse kept pretty steadily about 112. The dressing was changed as occasion required, the drainage tube dispensed with on the thirteenth day, and the sutures were removed from the coeliotomy wound four days later. She went home on the nineteenth day after the operation, a very small sinus at that time persisting. After one or two natural attempts the sinus finally closed in February of this year, but before that her jaundice had entirely gone. She has now (July 1921) made an excellent recovery, is entirely free from jaundice, strong, stout, and well, and able to do her housework and her washing.

The naked-eye appearances of the interior of such a cyst are admirably depicted by Evans in the *British Journal of Surgery*, July 1921, and this suggested to me the nature of the tumour. A series of closed cysts, in immediate relation to, but not in communication with, the bile ducts, had formed a tumour which not only compressed the common duct or the hepatic ducts, interfering with the excretion of bile from the liver, but had also prevented the influx of bile into the gall-bladder. It was not appreciated at the operation that the biliousness of the

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evacuated fluid was part of the general pigmentation of jaundice, and not an indication of communication with the biliary passages.

The portion of the cyst wall removed was submitted to Professor L. R. Sutherland, who reported that the tissues' density made sections unusually difficult to cut, that the cysts had a definite lining, and that their contents were homogeneous. At my request he supplied me with sections, in the examination of which I have had the invaluable assistance of Dr J. W. Dawson. The sections show the tissue to be in large part of a dense, yet cellular, fibrous character, resembling that of an inflammatory reaction of long standing, such as may be found in a cyst wall. Lining this wall is a very atrophied epithelium, the characters of which can scarcely be defined. In the substance of the fibrous tissue are a few small groups of gland elements, much compressed by the condensation, but still retaining an epithelium, of a columnar-palisade character, with an oval nucleus at its base: the type of epithelium is extremely suggestive of a bile-duct origin. In the superficial parts of the dense cyst wall, and also on its surface, are several smaller cysts of varying size, filled with a homogeneous, inspissated material in which have been a few cholesterin crystals. In each of these smaller cysts can be recognised a lining epithelium, very atrophic but still having the characters of the bile-duct cells.

The appearances are consistent with those of an adenoma of bile-duct origin in which the lumina of several of the acini or bile ducts, have become dilated to form one large and several smaller cysts. In the wall of the large cyst a slow inflammatory fibrosis has taken place, causing compression atrophy of the gland elements at the base of the cyst.

OBITUARY

F. W. N. HAULTAIN, M.D., F.R.C.P.

THE Edinburgh Medical School has suffered a severe loss in the death of Dr Haultain, who for more than a quarter of a century occupied a prominent place as an obstetrician and gynæcologist in the city.

Failing health curtailed his activities during the last year or two, but in spite of this he continued his work almost to the end, sustained by a determined will and resolute courage to carry on, in spite of difficulties which would have discouraged most men. The end came with unexpected suddenness and as a great shock to his colleagues and to a wide circle of friends throughout the country.

Haultain was born in Ceylon in 1861, and was thus up to the time of his illness in the full zenith of his activities, with a ripe and full professional experience. He came to Edinburgh as a child of three, and received his early education at Craigmount School, where he manifested his outstanding ability and his proficiency in outdoor sports from the first, characteristics which distinguished him during his subsequent life.

As a lad he came under the influence of Sir Alexander Simpson and Sir Halliday Croom, and these distinguished men undoubtedly were the main factors in determining him to embark on that special branch of the profession which he ultimately followed up with such success.

He graduated at Edinburgh University in 1882, and subsequently studied obstetrics and gynæcology in Prague and Vienna, obtaining a thorough foundation in and practical knowledge of his special department.

On his return to Edinburgh he assisted Sir Halliday Croom for some time in his class of midwifery and gynæcology in Minto House, and developed his teaching powers under these most favourable auspices. Soon thereafter he began teaching on his own account, and very quickly made for himself an enviable reputation as a teacher and operator which steadily increased year by year.

Possessed of great shrewdness, caution, and natural ability, combined with a kindly nature which endeared him to hosts of friends, he inspired confidence alike in patients and in doctors, so that it was little wonder that he established a large connec-

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tion. Moreover, his skill as an operator soon became recognised, and his services were greatly and justly in demand as an obstetrical and gynaecological expert.

He held strong views which he never failed to present and to uphold with characteristic energy, mingled with a pithy humour which helped greatly to enforce his arguments and to convince his hearers. His contributions were often characterised by a touch of genius which could not fail to impress and please those who heard him.

Haultain was above all a practical man. His active life gave him little leisure to devote to writing or research, but he kept himself fully abreast of the times by constant reading, and he had the faculty of absorbing and utilising what was best.

He contributed from time to time some excellent papers, especially to the Edinburgh Obstetrical Society (of which he was President in 1910-11), and to many medical journals. These contributions are all characterised by originality of thought and breadth of view.

He was a brilliant and skilful operator, and did much by his early and subsequent successes to establish the operation of hysterectomy for fibroids, and to bring it to its present assured position for suitable cases. His name will also always be associated with an operation devised by him for the treatment of inversion of the uterus.

In later years he devoted much time and study to the treatment of eclampsia by veratrine, to the question of early rising in the puerperium, and to twilight sleep. In fact he contributed a most interesting paper, and initiated a memorable discussion on twilight sleep at the Obstetrical Society so recently as in February last.

He was for fifteen years physician to the Royal Maternity Hospital, and at the time of his death was consulting obstetrician to that institution. He was gynaecologist to the Deaconess Hospital since its inception, and senior surgeon to the Women's Hospital in Archibald Place. He was also for the last four years a manager of the Royal Infirmary (elected by the Royal College of Physicians), and represented his department on the Medical Board.

From his boyhood Haultain was always keenly interested in the world of sport, and even during his busy years he found time during his brief holidays for his favourite recreations. He was a good shot, and a keen fisherman to the end of his life, and

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in his younger days was a cricketer and golfer of no mean order. He was vice-captain of the Carlton Cricket Club in 1895 and captain of the Mortonhall Golf Club in 1897.

He did not neglect the social side of life, and was always in great request at those medical and other symposia for which Edinburgh has been famous for more than a century. At such gatherings the busy professional man finds relaxation and emancipation for a short time from the strain of an arduous life. Haultain was for many years secretary of one of these social clubs, and the minutes of the proceedings which it was his duty to draw up from time to time were characterised by a fine humour which was greatly appreciated by all who heard them, and which has never been excelled by any of his predecessors.

Frank Haultain's memory will long be cherished by his friends, his professional brethren, and his patients.—J. H. F.

Others more competent will deal with Haultain's skill as an obstetrician and gynaecologist: I write of the man.

He was born in 1861 in Colombo, where his father was a coffee planter. The Haultain family came to England from Flanders at the end of the seventeenth century, and seem to have settled down in Worcestershire. One member of the family took part in the struggle for the independence of the Dutch Republic. They seem to have been a wandering race, and from England members of the family migrated to many of the Colonies and Dependencies of the Empire. Haultain's parents both died young, and he was adopted by a grand-aunt who lived in the Grange district of Edinburgh, and so began his connection with our city.

He was educated at Craigmount, then at the height of its fame and rivalling in games the Academy, Fettes, and Merchiston. He gained his cap both at football and cricket. His lack of inches—he was known at school as "the Midge"—was no doubt the reason why he did not play football at the University, but it was no bar to success at cricket, and he played for the Carlton Cricket Club for many years, keeping wickets with much success. At all games and sports which require a sharp eye he excelled. As a golfer he was for a time in the front rank, and for many years he played at the head of the Physicians' team, and skipped their first rink in curling matches. He was an excellent shot, and his skill at billiards was often the subject of the familiar jibe.

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His singular good nature and humanity made him hosts of friends. One would meet in his cosy smoking-room ministers of all denominations, distinguished soldiers, and captains of industry, old students returning to Edinburgh from the fringes of the Empire, coming to see their old teacher who never forgot them, and members of his own profession, young and old, who brought their problems for his sage advice.

He had an almost morbid horror of ostentation, and his name rarely appeared in public lists of subscriptions, but his private benefactions were large, and many a hospital patient's last days were made easier by his generosity. He presented the building which now houses the Hospital for Diseases of Women.

This reference recalls the fact that he was a pioneer in the matter of the Private Nursing Home. There was a time when the running of such homes was looked at rather askance by the profession. He knew of the feeling and considered the matter long and carefully before he opened his home in Archibald Place. His almost universal popularity did much to temper the criticism which arose: had it been started by some one less popular, it is probable that the advent of these homes in Edinburgh would have been postponed for years.

He was much more deeply interested in medical education than was generally recognised, and always maintained that the only way to learn obstetrics thoroughly was as resident in a Maternity Hospital. He grieved greatly over the closing of the Milne-Murray Home attached to the Maternity Hospital, in the establishment of which he took an active part, and it was characteristic of him to put up to the Directors of the Maternity Hospital a scheme for its better organisation which involved his own retirement.

He was a candidate for the Chair of Midwifery when Sir Alexander Simpson retired, and there were at least two occasions when he might have filled a Chair in other Universities. But he was very deeply attached to Edinburgh and put the suggestions aside.

The very large gathering of all sorts and conditions of men and women to pay him the last tribute of respect showed how widespread was his popularity.

His wife was a daughter of Dr Lindsay, at one time Superintendent of the Murray Asylum, Perth, and to her and their only child, Dr Theodore Haultain of Aberdeen, the sympathy of his friends goes out in full measure.—N. W.

STILL-BIRTH: ITS CAUSES, PATHOLOGY, AND PREVENTION.*

By F. J. BROWNE, M.D., F.R.C.S.E., Research Pathologist, Royal
Maternity Hospital, Edinburgh.

(*Working under the Medical Research Council.*)

THE following report is based upon a post-mortem examination of 200 consecutive cases of still-birth and neonatal death occurring in the Royal Maternity Hospital, Edinburgh, from 1st August 1919 till October 1920. Of these, 120 were still-births and 80 neonatal deaths.

The term still-birth is used in the more popular sense to include infants born dead at and after 28 weeks of pregnancy, as well as those born with the heart beating, but which failed to breathe after complete birth of the head and body.

The term neonatal death, on the other hand, is used to include all infants in whom respiration took place after complete birth, even though the child had only gasped a few times. Most of the neonatal deaths occurred in infants during the usual period of the mother's stay in hospital after confinement, viz., 10 days, but one or two are included in which death occurred as late as 5 or 6 weeks after birth.

In every case an effort has been made to co-ordinate the post-mortem findings with the clinical history of the parents and of the labour, and from the results of this co-ordinated inquiry such practical conclusions have been drawn with regard to the supervision of pregnancy, conduct of labour, and care of the newly-born infant as seemed to be warranted by them. The results have been classified and discussed in the following sections:—

- | | |
|--------------------------|-------------------------------|
| I. Craniotomy. | VI. Pneumonia. |
| II. Asphyxia. | VII. Suprarenal Hæmorrhage. |
| III. Maceration. | VIII. Premature Births. |
| IV. Cerebral Hæmorrhage. | IX. Scopolomorphine Narcosis. |
| V. Syphilis. | X. Miscellaneous. |

The problems presented by the termination of pregnancy at a period earlier than the seventh month are in many respects so different

* Abstract of Report to the Medical Research Council on *Still-birth: Its Causes, Pathology, and Prevention*, May 1921; communicated to the Edinburgh Obstetrical Society, 11th May 1921.

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from those encountered after that period that it seems preferable to make this the subject of a separate report.

I. Craniotomy.

Of this there were 19 cases, and of these 8 were primiparæ, 3 were ii-paras, 4 iii-paras, 1 iv-para, 1 v-para, 1 vi-para, and 1 vii-para; 17 were vertex, 1 breech, and 1 a face converted into breech; in one of the 17 vertex cases podalic version was performed, so that in 3 of the 19 cases craniotomy was performed on the after-coming head.

Reasons for Craniotomy.—These were as follows:—

Contracted pelvis	12
Excessive size of child	5
Hydrocephalus	2
	<hr/>
	19
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It is an interesting fact that 9 out of the 17 non-monstrous children were born to multiparæ, and that 7 of these 9 multiparæ, or 77 per cent., had previously given birth to full-time living children, in many cases without instrumental interference. In only three of the multiparæ, in whom it was necessary to perform craniotomy, was there any history of dystocia in previous labours, and one, a v-para, had had four previous full-time natural labours.

II. Asphyxia Neonatorum.

Of 120 cases of still-birth asphyxia was the cause of death in 49, or 40 per cent. These 49 included two cases in which craniotomy was performed after the child had been asphyxiated by prolapse of the cord. These two are also therefore included in the section on Craniotomy. In addition to these there are 15 cases of craniotomy in which the child was dead before that operation was performed, and probably in most of these death was due to asphyxia. As we shall see on the section on Cerebral Hæmorrhage, the latter is much less frequent as a cause of still-birth than asphyxia, but on account of the broken-up condition of the brain it was impossible to absolutely exclude it in these cases. It will therefore be understood that the number of deaths from asphyxia is really much understated, and if, as is not improbable, all the 17 deaths preceding craniotomy were due to asphyxia occurring during a prolonged second stage and repeated attempts at delivery, then the number of deaths from asphyxia neonatorum would be as many as 64 out of 120 still-births, or 53.3 per cent. For the purpose of the following analysis, however, the lower figures have been used as not being open to question.

Presentation.—Out of the 49 cases 38 were originally vertex,

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7 breech, 1 transverse with podalic version, 2 face, and 1 was delivered by Cæsarean section. Of the 38 originally vertex cases podalic version was performed in 7 cases, leaving 31 delivered by vertex, and in 1 face case podalic version was done.

Taking all the presentations together, there were 11 cases of *Antepartum* asphyxia, or 22.5 per cent., and 38 cases of *Intrapartum* asphyxia, or 77.5 per cent.

The causes of these may be classified as follows:—

Antepartum asphyxia (11 cases)—

Central placenta prævia	2
Marginal „	1
Lateral „	2
Concealed accidental hæmorrhage with acute albuminuria	1
External accidental hæmorrhage	1
External plus concealed accidental hæmorrhage	1
Eclamptic convulsions	2
Anæmia with hyperemesis	1
	— 11

Intrapartum asphyxia (38 cases)—

(A) *Vertex* (26 cases)—

(a) Prolapsed cord	7
(b) Prolonged second stage	12
(c) No cause ascertained	7
	— 26

(B) *Breech* (7 cases)—

(a) Prolapsed cord	1
(b) Contracted pelvis	1
(c) Difficulty with after-coming head	5
	— 7

(C) <i>Vertex with Podalic Version</i>	2
(D) <i>Face</i> (1 with Podalic Version)	2
(E) <i>Transverse with Podalic Version</i>	1
	— 5
	— 38
Grand total	49

On the cases of antepartum asphyxia little comment is necessary, except to say that in the 3 cases of accidental hæmorrhage the child was dead on admission; in two of these at least the hæmorrhage was associated with acute albuminuria. In one there was also concealed hæmorrhage with complete suppression of urine, delivery being effected by abdominal Cæsarean section, followed by hysterotomy. In the other case, a iii-para, acute albuminuria had developed in each pregnancy with birth of a premature infant, none of which had lived. During the present pregnancy she had been under observation since the fourth month. The urine was perfectly normal till the eighth month, when marked albuminuria again set in suddenly, and in spite of

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treatment in hospital a dead child was born, a mass of old blood clot being expelled behind placenta.

Prolapse of the Cord (8 cases).—The causes of this were as follows:—

Post-mature and over-ossified head preventing engaging .	1
Contracted pelvis	3
Breech	1
Arm behind head	1
Unascertained causes	2
	<hr/>
	8

Prolonged Second Stage (12 cases).—The causes of this were as follows:—

Contracted pelvis (2 with persistent occipito-posterior) .	4
Large child (1 " ") .	4
Primiparity (1 " ") .	3
Cord around child's neck (no other cause found) .	1
	<hr/>
	12

It will thus be seen that in 8 cases the cause of delay was want of proportion between the head and the pelvis. In 4 of these the fault lay in the pelvis, while in 4 the pelvis was normal, but the child excessively large, weighing 4000, 5250, and 6160 grms. respectively. All the cases of contracted pelvis occurred in primiparæ, but besides these there were 3 in which the primiparity was the probable cause of the delay in labour. At least, no other cause was discovered, except that in one there was also persistent O.P. Finally, in one case the delay seemed to be due to the fact that the cord was around the neck. The mother was a ii-para, and the labour, although slow, was non-instrumental. The child was rather below the average size, but the cord was excessively long, measuring 29 inches, and was wound twice tightly around the child's neck.

Of the 38 cases of intrapartum asphyxia, 26 were delivered as vertex and 11 as breech. If we reject the 2 cases of vertex presentation in which podalic version was performed after forceps had failed, and in which asphyxia might reasonably have been expected to occur had the presentation remained vertex; and if we assume 3 per cent. to be the normal frequency of breech presentation, we arrive at the conclusion that *asphyxia is eight times as likely to occur in breech as in vertex presentations.*

Post-mortem Appearances in Asphyxia Neonatorum.—These are in most cases fairly definite, and may be divided into internal and external.

External.—These are briefly, limpness and lividity. The limpness arises from the late onset of rigor-mortis, and the lividity from the excess of carbon dioxide in the blood. It is seen in the face and trunk, but is especially well marked in the finger and toe nails and

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in the mucous membranes. The conjunctiva is injected, and the mucous membrane covering the eyelids has a peculiar bluish red colour, which is quite characteristic.

Internal.—These consist mainly in subpleural and subepicardial hæmorrhages, with congestion of the internal organs. The blood remains fluid for a considerable period after death, and is unusually dark in colour. In a large proportion of cases there are also subcapsular hæmorrhages in the thymus, to which may, in rare cases, be added small interstitial hæmorrhages in the substance of the organ.

In some cases the only sign in addition to congestion of the internal organs and the fluidity of the blood is the presence of a few subpleural hæmorrhages, subepicardial hæmorrhages being entirely absent and *vice versa*, and occasionally neither subpleural nor subepicardial hæmorrhages are present. This is especially likely to be met with in premature infants in whom the respiratory centre is as yet improperly developed and attempts at intra-uterine respiration consequently weak or absent. In a few cases the hæmorrhages in the thoracic contents are not confined to the heart and lungs, but may also be found in the upper surface of the diaphragm, on the root of the aorta and pulmonary artery and even in the fibrous pericardium. These extensive hæmorrhages are most likely to be found in cases of antepartum asphyxia, such as occurs in concealed hæmorrhage, eclamptic convulsions, etc.

There is also reason to believe that the congestion of the organs in asphyxia can give rise to hæmorrhages in the suprarenal medulla, to subcapsular hæmorrhages in the liver, and to hæmorrhages in the brain, including the lateral ventricles.

Prevention of Asphyxia Neonatorum.—Of the antepartum cases, 6 may be treated as non-preventible, viz., the 5 cases of placenta prævia and the case of malignant anæmia. The classification of the 3 cases of accidental hæmorrhage will depend upon whether we look upon hæmorrhages as secondary to toxæmia or *vice versa*. If we accept the view advocated by Young¹ that hæmorrhage precedes and is the cause of toxæmia by giving rise to placental separation and necrosis, then the 3 cases of accidental hæmorrhage must be classified as non-preventible, except in so far as they are due to trauma or other preventible condition. If, on the other hand, we regard toxæmia as the primary condition, then these 3 cases must be classified as preventible. In any case, it is practically certain that the 2 cases of eclampsia could have been prevented by antenatal care.

An analysis of the 38 cases of intrapartum asphyxia reveals the fact that 33 may reasonably be classified as preventible, 1 (the face case with podalic version) as doubtful, and 4 as non-preventible. The last includes 3 of the cases of prolapsed cord (in 2 of which the cause

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of the prolapse was insufficiently ascertained and may have been preventible), and the one case of face presentation.

Amongst the preventible cases we find 3 cases of prolapsed cord and all the cases in which the second stage was prolonged, including those in which the cord was around the child's neck. The 7 cases of foetal death in contracted pelvis, and the two in which the child was of excessive size, could probably have been prevented by adequate antenatal supervision and induction of labour. In the same way the 7 breech cases and the transverse would have been discovered in the later weeks of pregnancy and external cephalic version carried out. There only remain 9 cases in which there was no abnormality of mother or child to account for death, two of these being associated with a prolonged second stage. These 9 cases emphasise the *importance of frequent examination of the foetal heart during the second stage*. When the child is in a posterior position this is not always possible, and the correction of posterior positions by external manipulation should be carried out as a matter of routine.

Finally, the *greatly increased liability to asphyxia in primiparae, on account of the rigidity of the tissues and prolongation of the second stage, even when the pelvis is normal and the child not excessively large, points to the desirability of inducing labour in some of these cases a little before full-time, unless the pelvis is more than usually roomy or the child below the average size.*

III. Maceration.

Amongst the 120 still-births there were 22 macerated foetuses, or 18.3 per cent. The causes of the foetal death in these cases may be tabulated as follows:—

Syphilis	14
Albuminuria	3
Diabetes	1
Doubtful	4
	<hr/>
	22

From the comparatively large number of cases classed as doubtful, it is evident that it may sometimes be a matter of some difficulty to determine whether a macerated foetus must be put down as syphilitic or not. This is all the more likely to occur in the case of specimens received from the district, generally without the placenta and often with little or no history. A Wassermann test is often not obtainable, even were it reliable, and the only real guide is the presence of spirochaetes in the foetal organs. Unfortunately, however, even in foetuses that are known to be syphilitic, spirochaetes are not always found, and one cannot fall back upon histological examination of organs available in the case of fresh foetuses.

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In the diagnosis of syphilis in cases of maceration reliance has been placed upon the following signs:—

1. Spirochætes in foetal organs. These were found in 8 of 14 syphilitic macerated foetuses. Every case was examined by dark ground and Levaditi methods, and the results of these two exactly corresponded.
2. Presence of active syphilis in the mother.
3. Strongly positive Wassermann reaction in the mother.
4. History of repeated still-births or abortions, or of premature births or neonatal deaths without other obvious cause.
5. Presence of syphilitic changes in the placenta.
6. Presence of chondro-epiphysitis.
7. Enlargement of foetal spleen.
8. Absence of other cause of antenatal death, e.g., albuminuria.

Speaking generally, it may be said that *while a strongly positive Wassermann reaction is of extreme importance, a negative Wassermann reaction may be ignored if there is a history of still-births and abortions without other obvious cause, even if there is no history of syphilis in the mother.* In such cases specific treatment may be instituted at once. If this is only started in the later months of pregnancy, intra-uterine death, or premature birth with early neonatal death will probably occur again, and it will then be most important to examine the placenta for signs of syphilis, the foetal tissues for spirochætes, and, if the foetus is fresh, to examine its organs both by naked eye and microscopically for signs of syphilis. *This complete histological examination of the products of conception forms perhaps the most constantly helpful method at our disposal for the diagnosis or exclusion of syphilis.* What these signs are will be indicated in discussing the subject of congenital syphilis in general.

IV. Cerebral Hæmorrhage.

Out of the 200 cases, cerebral hæmorrhage occurred in 59, or 29.5 per cent. Of these 24 were still-births and 35 neonatal deaths, and 20 were delivered as breech and 39 as vertex.

Method of Delivery in Vertex Cases.—Of the 39 vertex cases, 17 were forceps and 22 non-forceps cases; of the 17 forceps-cases, 9 were classified as difficult, while in 8 no special difficulty was encountered.

The causes of difficulty in the former were as follows:—

Contracted pelvis	6
Persistent O.P. and large child	1
Excessive size of child (4800 grms.)	1
Pelvis normal; child 3350 grms.	1
No other cause found

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Of the forceps cases in which no special difficulty was encountered, 3 were premature; 2 were eclamptic, and forceps applied to hasten delivery; in another the mother had mitral stenosis, forceps being applied in the second stage in order to shorten labour. The hæmorrhage in this case was slight, probably non-lethal, and death of the child 39 hours after birth was due to pneumonia. In another the mother had ventral hernia, and forceps were applied early in the second stage for a similar reason.

Non-forceps Cases with Cerebral Hæmorrhage.—Of these there were 22 in all, and all occurred in premature infants, the stage of pregnancy being as follows:—

7 to 7½ months	.	.	.	.	16
8	"	.	.	.	6
8½	"	.	.	.	...
					<hr/> 22

The liability to cerebral hæmorrhage in premature infants is thus greatest at 7 to 7½ months, still considerable at 8 months, while at 8½ months the liability appears to be no greater than at full-term. Further, it may be noted that *no case of cerebral hæmorrhage occurred in a full-time child in which delivery was a natural vertex.*

Again, of the 59 cases of cerebral hæmorrhage, 23 were in infants at full-time and 36 in prematures. If we take the normal proportion of full-time to premature infants to be 10 to 1, the *liability to cerebral hæmorrhage in premature infants is sixteen times that in those at full-time.*

Cases Delivered by the Breech.—Of these there were 20, only 9 of which were originally breech. The remaining 11 cases were converted into breech by internal version for various reasons which it is unnecessary to mention here in detail. It is enough to say that in 3 of the cases podalic version was carried out on account of dystocia. If we reject these 3 cases in which cerebral hæmorrhage might reasonably have been expected to occur had they remained vertex, there remain 17 cases of breech presentation in which cerebral hæmorrhage occurred out of a total of 56. Now, if we take 3 per cent. as the normal frequency of breech presentations, we arrive at the conclusion that *the liability to cerebral hæmorrhage in breech presentations is ten times that in vertex presentations.*

Operability in Cerebral Hæmorrhage.—There was no case of subdural hæmorrhage in the whole series in which the clot could have been removed by operation with hope of permanent cure. Even had it been possible to remove the clot over both hemispheres, in 4 of these it was associated with hæmorrhage into the lateral ventricle, in one with severe hæmorrhage into the medulla of the suprarenal, probably sufficient in itself to prove fatal, and in the

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remaining case where the hæmorrhage, though diffuse, over both hemispheres, was best marked around the Rolandic and Sylvian fissures on the left side; there was also a large clot overlying the left lobe of the cerebellum which could not have been reached. The most hopeful cases, naturally, are those in which only one cerebral hemisphere was affected. In 7 cases the hæmorrhage was confined to the left side, 4 of these being confined to the area immediately posterior to the Rolandic fissure. In one case, however, the hæmorrhage in the brain was associated with severe hæmorrhage into the pelvis and pyramids of the kidney and into the mesentery of the small intestine. In a second case in which the clot, 2 inches in diameter, overlay the left cerebral hemisphere, its upper border reaching to the parietal eminence and its lower to the outer border of the mid cranial fossa, the clot was subdural, and when the flap of parietal bone was turned down, with the dura adherent to it, the clot still remained adherent to the dura and turned down with it. This clot could have been entirely removed, but there were present two other large clots which could not have been reached or even seen, one lying over the posterior part of the corpus callosum and the other over the left lobe of the cerebellum.

A third case was associated with hæmorrhage in both lateral ventricles, a fourth with subcapsular hæmorrhages in the liver, one of which had ruptured into the peritoneal cavity. In a fifth there was a large blood clot, the size of a hen's egg, in the left cerebral hemisphere. The child had lived 5 weeks, and no symptoms has been noted except marasmus; though the clot was circumscribed, and could probably have been entirely removed, yet the brain was badly ploughed up by the effusion of blood.

With regard to the extradural hæmorrhages, the same statement applies—that underneath the parietal bone being associated with extradural hæmorrhage over both supra-orbital plates, the latter being fractured.

Tears of the Dural Septa.—Out of a total of 94 fresh foetuses observed, tears of the tentorium cerebelli were found in 35, or 37 per cent. Of these delivery was by breech in 22, or 63 per cent., by vertex in 12, or 34 per cent., and by face in 1, or 3 per cent. Rejecting 5, those delivered by breech in which podalic version was performed for dystocia, and assuming 3 per cent. to be the normal frequency of breech presentation, we arrive at the conclusion that *breech delivery is sixteen times more likely to give rise to tentorial tears than is vertex.*

Of the 35 cases of tentorial tearing observed, the tear was complete in 21. In 13 of these there were complete tears on both sides, in 3 on the left side only, and in 5 on the right side only. Of incomplete tears, there were 18 cases, in 5 of which the tearing was

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on both sides, in 5 on the right side only, and in 8 on the left side only; in addition, there were 3 cases of tearing of the falx cerebri.

A consideration of the method and nature of delivery (for details see original papers and appendices) leads us to conclude that while complete tears of the tentorium are exceedingly likely to occur in difficult breech cases, yet they may also occur in breech cases in which there has been no difficulty whatsoever—in easy and premature labours; and while in vertex cases complete tears may frequently occur in forceps deliveries they are not confined to these, but may also occur in cases where delivery has been spontaneous but prolonged and somewhat difficult. In no case, however, did tentorial tearing of any degree occur in an easy and natural vertex delivery. Further, in every case of breech delivery at full-term some degree of tentorial tearing was observed, complete tears being nearly twice as frequent as incomplete. It is evident therefore that the problem of the prevention of injuries to the tentorium cerebelli is inextricably bound up with that of the prevention of breech and difficult vertex delivery.

Relationship between Tears of the Dura Septa and Cerebral Hæmorrhage.—Out of the 50 cases in which either septal tearing or cerebral hæmorrhage, or both together occurred, there were 21 cases in which there were tears of the dural septa, and in which there was no cerebral hæmorrhage. This means that out of a total of 35 cases of tentorial tearing, 21, or 60 per cent., were unassociated with cerebral hæmorrhage: in 8 of these cases the tear in the tentorium cerebelli was complete, and in 7 of these it was complete on both sides.

Looking at the matter from the other point of view, we find that out of a total of 29 cases of cerebral hæmorrhage there were 15, or 51 per cent., in which no tears of the dural septa occurred, and all of these were cases of premature birth.

Cases in which Tears of the Dural Septa and Cerebral Hæmorrhage co-existed.—Of these there were only 14 cases out of the total 50 in which septal tears and cerebral hæmorrhage existed together or separately, that is to say, tears of the septa and cerebral hæmorrhage existed together in only 28 per cent.

An analysis of these (for details, see original paper) shows that in 3 of these 14 cases the hæmorrhage around the base of the brain was derived from either the straight or lateral sinuses, the tentorial tear having extended directly into it. In 3 others the hæmorrhage was into the substance of the tentorium and due directly to the injury to it. In 2 other cases the clot overlay the tentorium and was derived from the torn vessels of the tentorium itself, or from tearing of the veins that run directly downwards from the under surface of the occipital lobes to the lateral sinus, probably the latter. In 3 other cases the hæmorrhage occurred at regions of the brain remote from the base,

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viz., the frontal lobe and the upper surface of the cerebral hemispheres, and therefore remote from the region drained by the great cerebral vein. Three cases therefore alone remain. The source of the hæmorrhage in these was obscure, and may be explained by the theory advocated by Holland,² of obstruction and rupture of the vein of Galen and its tributaries by excessive moulding of the foetal head consequent upon tears of the dural septa.

Intra-Ventricular Hæmorrhage.—There were 22 cases in which there was hæmorrhage into the lateral ventricles. In 12 it occurred into both, and in one of these it was associated with hæmorrhage into the fourth ventricle, this being the only case in which the child was born dead. In 3 cases the hæmorrhage occurred into the right ventricle only, and in 2 into the left only. In 5 others the hæmorrhage was merely subependymal, viz., underneath the ependyma covering the floor of the ventricles, and therefore, strictly speaking, should not be classed as intra-ventricular at all.

Stage of Development.—Eighteen occurred from 7 to 7½ months; two occurred at 8 months. Thus it may be stated that intra-ventricular hæmorrhage only occurred in premature infants at and below 8 months.

As a matter of practical experience, one does not expect to find intra-ventricular hæmorrhage in full-time infants.

Extent of the Hæmorrhage.—In most cases the clot is large enough to distend the ventricle considerably, is somewhat worm-shaped, almost black in colour, and commonly measures 1½ inches by ¼ inch. As stated above, in only one case did death occur before delivery. All the others were cases of neonatal death, the duration of life varying from ½ hour to 3 days. In the latter case both lateral ventricles were distended with blood clot.

Presentation in Intra-Ventricular Hæmorrhage.—Of the 22 cases, 5 were delivered by breech and 17 by vertex. Taking again 3 per cent. as the normal frequency of breech cases, and rejecting the 5 cases in which the hæmorrhage was merely subependymal, we arrive at the conclusion that *breech delivery is ten times more likely to give rise to intra-ventricular hæmorrhage than is vertex*—a result exactly corresponding to that arrived at for cerebral hæmorrhage in general.

Method of Delivery.—All the labours were easy, and all were spontaneous except one, which was delivered by forceps. These were applied in this case merely to hasten delivery, the child being at 7½ months, the first of twins, and the mother eclamptic.

Cause of Intra-Ventricular Hæmorrhage.—From the deep and protected situation of the ventricles it is unlikely that the hæmorrhage can be explained by trauma due to the skull bones being more mouldable in the premature passenger. If this were so, one would expect

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the most extensive hæmorrhage to occur not over the base of the brain nor in the protected ventricles but over the upper surfaces of the cerebral hemispheres. In the premature infant the latter compared with the ventricles and the base is an infrequent site for cerebral hæmorrhage, and the hæmorrhage, when it occurs, is rarely sufficient to cause death. Besides, it would not explain the 6 cases of intra-ventricular hæmorrhage in which it occurred in no other situation. Clearly, it must be due to some cause which affects the vessels at the base of the brain and those in relation to the ventricles, at least equally with those of the upper surfaces of the cerebral hemispheres. It is not due to tearing of the tentorium cerebelli and consequent kinking of the vein of Galen, as the former was intact in all the cases of intra-ventricular hæmorrhage. It would seem to be due entirely to the determination of blood to the brain occurring during labour, the fragile vessels being insufficiently developed as regards their muscular and elastic coats to bear the abnormal strain.

In breech cases it is extremely likely to occur from pressure upon the cord insufficiently prolonged to cause asphyxia or from gripping of the child's neck by the partially dilated cervix. In vertex presentations also it is evident that an increase of cerebral blood pressure and congestion of the cerebral veins occurs, though perhaps to a less extent than in breech cases, while the enormously increased blood-pressure in asphyxia, whether occurring in breech or in vertex deliveries, will be extremely likely to result in hæmorrhages, whether intra-ventricular or otherwise.

Another factor in the causation of cerebral hæmorrhage in the premature infant is the deficient coagulability of the blood. Dr Janet Murray and the writer are at present carrying out an investigation into the coagulability of the blood in young infants, and the results, so far, indicate that the coagulation time in the premature infant is distinctly prolonged, as compared with that of the full-time infant. For these two reasons—the fragility of the vessels and the deficient coagulability of the blood—the premature infant is unfitted to pass with impunity through the parturient canal.

Conclusions.—(1) Out of a total of 200 cases there were 59 cases of cerebral hæmorrhage, or 29.5 per cent.

(2) The liability to cerebral hæmorrhage in breech presentations is ten times that in vertex.

(3) Among vertex presentations at full-time cerebral hæmorrhage is most likely to occur in difficult forceps deliveries, but may also occur in forceps cases where there has been no special difficulty but in which rapid delivery has had to be effected.

(4) No case of cerebral hæmorrhage occurred in a full-time vertex where delivery was natural.

(5) The liability to cerebral hæmorrhage in premature infants is

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about sixteen times that in infants at term ; it is greater from 7 to 7½ months, less at 8 months, while at 8½ months the liability appears to be no greater than at full-time.

(6) In premature infants the hæmorrhage seems to be independent of the tears of the dural septa, and is probably due to over-filling and bursting of the fragile intracranial veins in both vertex and breech deliveries together with decreased coagulability of the blood, the liability to this over-filling and hæmorrhage in premature breech cases being about seven times that in premature vertex cases.

(7) Tears of the dural septa were found in 37 per cent. of 94 cases observed, only 40 per cent. of these cases being associated with cerebral hæmorrhage.

(8) Breech delivery is about sixteen times more likely to give rise to tears of the tentorium cerebelli than vertex delivery, and the liability of breech deliveries to cause tentorial tears is not confined to cases of difficult delivery, but is also present in easy and premature cases. In every case of breech delivery at full-time some degree of tentorial tearing was observed.

(9) In vertex cases tentorial tears are most likely to occur in difficult forceps cases, but may also occur in cases of spontaneous delivery where labour has been prolonged and moulding of the head therefore excessive. In no case did tentorial tearing occur in an easy and natural vertex delivery. (Compare this with breech cases.)

(10) Hæmorrhagic diathesis does not appear to play any important part in the causation of cerebral hæmorrhage.

(11) Intra-ventricular hæmorrhage occurred in 17 cases, or 8.5 per cent. Its occurrence is confined to cases of premature birth, and the cause would seem to be the same as that of hæmorrhage in premature infants in general and is independent of tears of the dural septa. It is ten times more likely to occur in breech than in vertex presentations.

(12) No case could have been permanently benefited by operative measures directed to removal of the clot. The hæmorrhage was too widespread, or was associated with hæmorrhages in other parts of the brain beyond sight or reach, or with hæmorrhage into other organs, or the brain tissues had been too much damaged to allow of complete restoration of function in later life.

(13) No case of the whole series except two received adequate antenatal supervision.

(14) The points to be kept in mind in the prevention of cerebral hæmorrhage are as follows :—

- (a) *Avoidance of breech deliveries*, by cephalic version of breech presentations at a period when this is always possible, viz., not later than the 7th or 8th month.

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- (b) Avoidance of difficult forceps deliveries ; this is only possible by antenatal supervision of every case.
- (c) Avoidance of induction of premature labour, certainly before 8 months ; better still, before $8\frac{1}{2}$ months.
- (d) Manual dilatation of the parturient canal for the passage of the premature infant and preservation of the membranes unruptured as long as possible. We shall see later that the latter has also an important bearing on the question of infection of the newly-born infant.

Finally, after a study of the above series of cases, it is impossible to avoid the conclusion that it is only by adequate antenatal supervision of every pregnant woman that the present high morbidity rate from cerebral hæmorrhage can ever be seriously diminished.

(To be continued.)

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Studies in the History and Method of Science. Edited by CHARLES SINGER. Vol. II., pp. xxii + 559, with 55 Plates and 82 Illustrations in the text. Oxford: Clarendon Press. 1921. Price 48s. net.

The first volume of this series appeared in 1917, and its great success has led to the production of the present sumptuous book and to the editor's statement that these Studies will in future appear regularly as an annual volume. The work comprises a collection of essays upon fifteen unconnected subjects in the history of science, biological, mathematical, physical, and speculative. Of these subjects the most elaborate and instructive essays deal with "Greek Biology and its Relation to the Rise of Modern Biology," by Charles Singer; "Roger Bacon and the State of Science in the Thirteenth Century," by Robert Steele; "Leonardo as Anatomist," by H. Hopstock; "The Scientific Works of Galileo," by J. J. Fahie; "Steps leading to the Invention of the First Optical Apparatus," by Charles Singer; "A Sketch of the History of Palæobotany," by E. A. Newell Arber; and "Archimedes' Principle of the Balance and some Criticisms upon it," by J. M. Child. The plates, coloured and plain, dealing with Ancient Greek and Early English representations of medicinal plants and animals, with Leonardo da Vinci's anatomical notes, with the instruments invented by Galileo, and with early palæographical engravings, are admirably reproduced and add greatly to the value and attractiveness of the book.

It will be noted that the balance between the history of different branches of science is well maintained; and thus in view of the great and constantly increasing interest that is now manifested in most of these, the present volume is bound to appeal to a very wide circle of scientific workers. As the editor remarks, "We may well look to this new orientation of scientific teaching to counteract the effects of the regrettable but real decline in the study of the older humanities," and both he and the publishers are to be congratulated upon the continued success achieved by this second volume.

Clinical Surgery by Case Histories. By A. E. HERTZLER. 2 vols, pp. 1106, with 483 Illustrations. London: Henry Kimpton. 1921. Price £5 net.

A concatenation of case-reports accompanied by photographs may be a basis on which individual experience is built, but in the crude form here presented scarcely merits publication and is not a means by which instruction can be conveyed to others. A

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chapter on "general principles" precedes the collection which is amusing if not instructive reading. Much of surgical interference is necessitated on account of "perverted physiology," hence, "physiology, not anatomy, becomes the guiding science," and the surgeon is advised to "act with boldness and dispatch when time is more important than detailed knowledge." "The besetting sin of the surgical profession," we are informed, "is undue speed," which may "be due to an innate tendency which finds satisfaction only in slashing and spattering of blood." We congratulate ourselves that this type of "surgeon" is still unknown here. Surely it is a physiological inaccuracy to write of an endocrine "system." A repetition of 2 Cor. i. 17 will convince the recorder that the passage "yea yea, and nay nay" though "biblical" is not an "injunction."

The case-histories which occupy a thousand pages give quantity not quality and are not for emulation, and few of the photographs are more than moderately good; some exceedingly poor. Half the number of recorded cases with twice the work on each would not raise this book to the level of the good American publications. The sections on the tongue and mouth, and on the generative organs, fare better because photographs are replaced by wood-cuts, while the fairly uniform standard of photomicrographs suggests an extraneous selector.

The reviewer is puzzled by many terms, *e.g.*, "benign epithelioma," "plant physician," etc., but the repetition of "trachina" and "trachinous" for the well-known nematode worm and the affection it produces indicates want of knowledge rather than want of care.

The recorder (we cannot call him "author") seems to think that professional brethren in difficulty will turn over the pages of this book until an illustration suggests a similarity and will then read the case-record, but this is subversive of all scientific principles.

Studies in Deficiency Diseases. By ROBERT M'CARRISON, M.D., D.Sc., F.R.C.P. Pp. xvi + 270, with 82 Illustrations. London: Henry Frowde and Hodder & Stoughton. 1921. Price 30s. net.

The idea that disease might be due to the absence of certain essential substances from the diet is by no means new, for it was suggested by Blane in regard to scurvy more than a century ago. It is only, however, during the past few years that direct proof has been given of the existence of a definite class of deficiency diseases, due either to the lack of certain vitamins or certain amino acids in the food. There has already collected on the subject of deficiency diseases a large and rapidly growing literature to which the present work forms a highly important contribution, since it serves both to

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emphasise the knowledge already acquired, and the ignorance which still exists in regard to normal metabolism. Although deficiency diseases are more commonly recognised as occurring among natives in tropical or sub-tropical climates, the possibility of such diseases arising in Western communities is by no means negligible, since with modern methods of manufacture there is considerable chance of destroying the vitamins in our food. Colonel M'Carrison's experiments on pigeons, monkeys, and guinea-pigs when fed on ill-balanced diets lacking in one or more vitamins are considered in detail, considerable space being naturally devoted to a consideration of vitamin B on which much of the author's work has been carried out. Of special interest in this connection are the pathological changes which occur in the intestine and above all in the endocrine organs. The increased load of adrenalin in the adrenals in experimental beriberi is extremely striking, though whether this increase can be directly correlated with the occurrence of œdema is still somewhat doubtful. Although beriberi and scurvy must be looked upon as due to the absence of vitamins from the diet, the etiology of pellagra and rickets still remains unsettled. In regard to the former disease, Colonel M'Carrison rather favours the view of Goldberger that the condition is due to a combined deficiency of proteins and vitamins. In a final section the practical applications of the experimental results are indicated. Although at the present time there is probably an exaggerated tendency to ascribe to a lack of vitamins all and every disease of unknown etiology, nevertheless there are good grounds for believing that in many pathological conditions a deficient or ill-balanced diet may play a not unimportant part. Colonel M'Carrison's book will prove of inestimable value to those who are especially interested in deficiency diseases, but it should be read with care by all who desire to keep themselves well informed of modern advances in the science of nutrition.

Human Physiology. By Professor LUIGI LUCIANI, Director of the Physiological Institute of the University of Rome. Edited by M. S. Pembrey, M.A., M.D. Vol. V., Metabolism, Temperature, Reproduction, etc. Pp. 452, with 158 Illustrations. London: Macmillan & Co. 1921. Price 30s. net.

The fifth and last volume of the veteran Professor Luciani's treatise on Human Physiology covers a considerable range of subject matter. The first three chapters deal with metabolism, thermic economy, and the theory of human nutrition. The discussion of metabolism is introduced by an interesting account of the history of research into the subject, and a criticism of the various methods

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of estimating the intake and output balance. The chapter on nutrition provides a lucid and highly practical discussion of the best known dietetic theories, which is calculated to be most useful to the practitioner. The most recent work on vitamins is not included, but the necessary references are provided in a footnote by the editor.

The next few chapters cover the subject of reproduction. Following upon a description of the anatomy and physiology of the male and female organs of generation, the physiology of pregnancy, parturition, and the puerperium are taken up. All these subjects are most adequately described, and in every section the practical application of the science is kept clearly in the forefront.

This naturally leads on to a chapter on the stages of life and death. The physiology of the new-born infant is followed by discussions of the physiological characteristics of the various periods of childhood, youth, maturity, virility, the critical age in man as well as in woman, the various theories of senility, and of the real nature of death. The last chapter is devoted to a comparative physiological study of the various human races, and to a critical examination of the different attempts at classification of them, which have been made by different authorities.

A bare enumeration of its contents is, however, by no means sufficient to indicate the value of this book. One is compelled in the first place to remark on the peculiar grace and charm of the literary style of the writing. The translation is masterly and has been performed with a rare sympathy. It is difficult to imagine that much of the perfection of the original can have been lost in the process. In the second place, the easy lucidity of the descriptions and the simple but skilful marshalling of all the salient points is impressive. The author writes throughout as one who remembers the practical application of his science, not alone to the science and art of medicine, but also to the art of living. The combination of these features with the erudition and great experience of the author put the work in a place by itself amongst modern text-books of physiology, and should suffice to secure for it a great welcome from multitudes of medical men and others who find the ordinary works on the subject so saturated with mathematical formulæ as to be almost incomprehensible except by the elect.

Perhaps the chapter on the stages of life and death is the most fascinating in this volume, and all practitioners will be interested in Professor Luciani's theory as to death. As an example of the truly philosophic breadth of view which characterises the whole volume, one might cite the pages upon the fear of death which is inherent in Man, along with the account of the "almost joyous"

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death in Rome of F. W. Myers, the author of *Human Personality*, and the reproduction of Domenichino's famous picture of St Jerome receiving the *Viaticum*—examples respectively of triumph over the fear of death through a living belief in immortality based on pure reason, and through a similar belief based upon religious faith.

The present reviewer has not had the privilege of reading the first four volumes of this great work. It is an omission which he hopes to rectify at an early date. But if, as may well be believed, they are all on the same high plane of excellence as this last one, the whole work must easily rank as the most delightfully readable, lucid, and stimulating treatise on modern physiology which is available in the English language. The translator, editor, and publishers deserve the grateful thanks of the profession for placing Professor Luciani's work within our reach.

Gout. By LL. JONES LLEWELLYN, M.B.(Lond.). Pp. xviii + 469.
London: William Heinemann. 1920. Price 30s. net.

The essential nature of gout is a problem which is not yet definitely solved in spite of much discussion and research.

In this work are presented the various theories of gout which have been from time to time advanced, and the light thrown upon them by the progress made in the fields of bacteriology and bio-chemistry. The gradual differentiation of various other forms of arthritis and the demonstration of their causation by bacterial infection are contrasted with the reluctance which has been displayed to abandon the idea of the purely metabolic origin of gouty arthritis.

The rise of the infective theory of gout is sketched, and the writer declares his adherence to it. He believes that in gouty subjects there is an inherent abnormality of nuclein metabolism and an increased tissue affinity for uric acid, but that it is by the occurrence of infections or sub-infections in these subjects that their latent tissue peculiarities become manifest as gout. He adduces the presence, in most cases, of local foci of infection and the symptoms of fever, leucocytosis, and glandular enlargement, as supporting an infective element in the disease.

A considerable section is devoted to a clinical account of the malady and to its diagnosis. The detection of tophi is emphasised as the one reliable criterion for distinguishing gout from other forms of arthritis, skiagraphy failing to differentiate the joint lesions from those of rheumatoid arthritis. In this connection attention is drawn to the fact that tophi, in their early stages, are soft, largely fluid swellings, and aspiration with a hypodermic needle, with subsequent examination of the fluid for biurate crystals, is recommended in doubtful cases. Treatment, dietetic, medicinal, and hydro-therapeutic, is fully discussed.

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W. M. Beaumont contributes a chapter on ocular disease in the gouty. He finds that there is no specific "gouty" ocular disease. The book is a valuable presentation of the very complex subject with which it deals, and contains much of great interest and usefulness from a practical standpoint.

Gonococcal Infection in the Male. By NORMAN LUMB, O.B.E., M.B., B.Sc.(Lond.). Pp. xii., with 178 illustrations. London: John Bale, Sons & Danielsson, Ltd. 1920. Price 25s. net.

This volume is essentially a practical one, in which the author puts in clear and lucid terms the technique and methods which he has found most useful in the diagnosis and treatment of gonorrhœa and its complications. In addition to his own large clinical experience he has made a careful study of modern literature on the subject, extracts from which greatly enhance the value of the book.

Great importance is attached to urethroscopy, both in treatment and in the diagnosis of cure, and this section of the work is carefully written and well illustrated. While one may not agree with the author in some of the methods advocated, *e.g.*, the use of silver nitrate in strengths of gr. x. to the ounce to abort an established urethritis and in the later stages to set up a chemical urethritis with a view to establishing the certainty of cure, these are minor points and militate little against the value of the work as one of the most practical and useful text-books that have appeared on this subject.

International Clinics. Thirtieth Series. Vols. I-IV. Philadelphia and London: J. B. Lippincott Company. 1920. Price £2, 2s. the set of 4 vols.

The set of four volumes for 1920 are now published. Sections are devoted to every branch of medicine and surgery. Under the heading of Clinics several interesting articles appear. These for the most part quote a series of cases, their history and treatment. "Influenza and its Complications in Children" is reviewed in the light of recent epidemics and should prove of value. In Vols. 2 and 3 a new feature is introduced in "Industrial Surgical Clinics." The objects of these clinics is primarily to call attention to the diagnosis and treatment of surgical conditions resulting from industrial accidents; but the other questions, both medical and legal, which arise so frequently in this type of case are also considered. The illustrations in these volumes are without exception of a high order and add greatly to the value of the articles which they accompany. A general index is included.

NEW EDITIONS

The Röntgen Diagnosis of Diseases of the Alimentary Canal. By RUSSELL D. CARMAN, M.D. Second Edition. Pp. 276. Philadelphia: W. B. Saunders Company. 1920.

The unrivalled material and equipment of the Mayo Clinic have been utilised to advantage by Dr Carman in this book, which is quite outstanding among works as the radiography of the digestive organs. No small part of its merit resides in the beautiful illustrations, which are alike instructive and valuable for reference. This edition has been extensively revised, and new chapters have been added on hour-glass stomach and pneumoperitoneal diagnosis. Dr Carman writes guardedly on the production of pneumoperitoneum for diagnostic purposes, and evidently looks on it as doubtfully justifiable. The technique of opaque meals is fully discussed, and the clinical findings are illustrated by a great many individually interesting cases. The book is eloquent of the possibilities of refinements of this form of diagnosis when adequate facilities exist.

A Short Practice of Midwifery. By HENRY JELLETT, B.A., M.D., F.R.C.P.I., Ex-master, Rotunda Hospital. Eighth Edition. Pp. xvi + 533, with 240 illustrations. London: J. & A. Churchill. 1921.

This, the eighth edition of Dr Jellett's smaller book on Midwifery, has been thoroughly revised and brought into line with the practice of the Rotunda Hospital as carried out during his mastership. It reflects exactly what are known as the Dublin methods, and gives a succinct and clear indication of the Rotunda teaching and practice. The use of the plug in abortion in placenta prævia and in accidental hæmorrhage, so strongly advocated by successive masters, has now come to be regarded by most obstetricians as the best treatment in the majority of cases at certain stages. The same cannot be said of the treatment recommended for eclampsia. Many will dissent from the use of chloroform and morphia in this condition, as advised by Dr Jellett. They will prefer either to control the attacks when frequent, or use veratrine or other sedatives to prevent them. One is rather surprised by the author's statement that when pubiotomy is considered necessary it should be done about the middle of pregnancy as a prophylactic measure. By most who approve of the operation at all, it has been regarded as a last resort in order to get a living child when forceps have failed to deliver, and when the opportunity for induction of premature labour or of Cæsarean section has passed. It is disappointing to find that the subject of

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morphia-scopolamine narcosis during labour, so much discussed at present, is dismissed in only a few lines. It would have been interesting to know the experience of the Rotunda Hospital with this treatment.

We can, however, most thoroughly recommend Dr Jellett's book as a reliable and up-to-date guide in the practice of midwifery: it is most readable and it is short.

Normal Histology. By GEORGE A. PIERSOL, M.D., Sc.D., Professor of Anatomy in the University of Pennsylvania. Pp. viii + 418. With 438 Illustrations. Twelfth Edition. Philadelphia and London: J. B. Lippincott Company. 1920. Price 21s. net.

The aim, stated in the preface, "to give the salient features of the various structures," has been very successfully carried out, for in few books is it possible to find a clearer and more lucid account of the structure of an organ. Special mention may be made of the descriptions and diagrams relating to the architecture of the unit of structure of an organ or of reconstructions of parts.

The problem in writing such a book must be mainly concerned with the difficulty in preserving a balance in selection. The judgment exercised throughout is almost wholly to be commended, yet certain sections, *e.g.*, those dealing with the protoplasm of the cell, the origin of the lymphatic ducts, and the structure of the liver lobule, and the chapters on the glands of internal secretion, and the central nervous system are very brief and condensed. The whole book is illustrated and printed in a way that gives pleasure in reading, and is completed by a brief appendix which gives the most useful methods of histological technique.

Gynaecology. By T. WATTS EDEN and CUTHBERT LOCKYER. Second Edition. Pp. xvi. + 928, with 537 illustrations. London: J. & A. Churchill. 1920. Price 38s. net.

The second edition brings this well-known text-book up-to-date. It still remains the most complete one-volume manual of gynaecology published in Great Britain, and the appearance of a new edition so quickly indicates that it has filled a want.

In size and detail the book is more valuable for advanced students and practitioners than for students reading for the ordinary examinations. There is a tendency to scatter the narrative, especially in the pathology, which renders the book too heavy for easy reading. For example, the pages on chronic endometritis—which is always a difficult subject—make more for added confusion than for clearness.

Despite these defects in method the book remains one of the most valuable text-books on gynaecology in the English language.

TRANSACTIONS, REPORTS, ETC.

The latest volume of the *Transactions of the American Gynecological Society*, edited by GEORGE GRAY WARD, Jr., M.D. (Wm. J. Dornan, 1919), does not fail to supply much interesting reading. Good discussions took place on Elective Cæsarean Section on Nutrition of the Fœtus and on Radium Treatment of Uterine Cancer; whilst single papers of special interest were those of Dr Whitridge Williams on "An Early Ovum in Situ in the Act of Aborting," of Dr Howard Kelly on "Papillary Tumours of the Bladder," of Dr Henry P. Newman on the "Relation of Preventive Medicine to Gynecology," and of Dr Hugo Ehrenfest on "Specific Diet of the Mother during Pregnancy." Dr A. B. Spalding's article on "A Study of Frozen Sections of the Pelvis" is well illustrated, as is also Dr Whitridge Williams' paper above referred to. The Society has no need to be ashamed of its annual addition to the literature of Gynecology and Obstetrics.

The thirty-first volume of the *Transactions of the American Pediatric Society* contains as usual a number of interesting papers. Most of these have already appeared in periodicals, but are none the less worthy of being gathered together in permanent form.

The early numbers of two new journals on the youngest of the ancillary sciences—medical psychology—have reached us. *The Journal of Neurology and Psychopathology* (John Wright & Sons, Ltd., price 3os. per annum) is under the direction of a strong editorial committee consisting of Drs Kinnier Wilson, T. Graham Brown, and R. M. Stewart for Neurology, and Bernard Hart, Henry Devine, and Maurice Nicoll for Psychopathology. The matter in the first number is excellent, and is divided into original articles, clinical records, critical reviews, and abstracts. If the standard set at the outset is maintained, the journal will do credit to English neuropathology. The *International Journal of Psycho-analysis*, directed by Professor Freud, and edited by Dr Ernest Jones, is described as the official journal of the International Psycho-analytical Association. From a prefatory note it seems that the new journal is associated with, but not a mere duplication of, the *Internationale Zeitschrift für ärztliche Psychoanalyse*, which in existing circumstances cannot be expected to fulfil satisfactorily its international function. One of the objects of the new journal is to counter opposition to Psycho-analysis, particularly that which cloaks itself in the guise of friendliness, and (unconsciously) subverts the pure faith by a specious misuse of psycho-analytic terminology, and diluting disagreeable truth with palatable

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truisms. In fact, very much what some ribald critic of Matthew Arnold described as "the watering down of Providence into a stream of tendency." Notwithstanding the rather assertive note struck in the preface, the contents of the first number go far to dispel antagonism. The scope of the journal is ambitious and goes beyond the clinical sphere to embrace pure and applied psycho-analysis—that is, its relation to literature, mythology, anthropology, and so on. Our own feeling is that in the nature of the case, the therapeutic use of psycho-analysis will come to be looked on as the least important service it does to mankind, and that on the other hand we are only now beginning to glimpse the possibilities that its applications in education, in sociology, in religion, and in anthropology, generally opens up. For this reason we wish the new venture well, and congratulate the promoters on their choice of Dr Ernest Jones as editor. It is published by the International Psycho-analytic Press, London, and the subscription rate per volume is 30s.

The American Year-book of Anæsthesia and Analgesia, 1917-18, edited by F. H. M'Mechan, M.D., A.M., pp. 483 (New York City: Surgical Publishing Company, 1921). The publication of this, the second year-book of Anæsthesia and Analgesia, has been delayed by the exigencies of the Great War. The book is arranged on the same lines as its predecessor, and, although perhaps on the whole not so good, is of very great value and interest. There are nearly one hundred papers, mostly by American writers, but some are of British and French origin. These are grouped under such headings as the complicating and the safety factors of anæsthesia, the blood and circulatory disturbances, and the pharmacological actions of anæsthetics, local and general. Special methods of anæsthesia are discussed, and there is a long section devoted to anæsthesia in war surgery, which would naturally have been of more interest a few years ago. Local anæsthesia both in general surgery and in the various specialties is treated at great length, and the book ends with a very full bibliography of the current literature of anæsthesia, which in itself should be of lasting value. The contents cover such a wide field that there is no medical man or dentist who would not find something of real interest to him whether of a practical or of a purely scientific nature. The printing and get-up of the book are excellent, and like its predecessor, we give it a hearty welcome.

The Transactions of the American Pædiatric Society, now in its thirty-second volume, provides as usual an excellent résumé of the chief advances in pædiatrics during the year.

Among new periodicals we have to notice No. 1 of the first volume (fourth series) of *Guy's Hospital Reports*, which now appears

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as a quarterly, edited by Dr Arthur Hurst, and published by Messrs Frowde and Hodder & Stoughton. The contents are of wide interest, and the price of the single number is 12s. 6d. From the Cambridge University Press comes the first part of *The British Journal of Psychology* (medical section), 10s. net, edited by T. W. Mitchell. The contributors include Pierre Janet, Myers, M'Dougall, Constance Long, and Ernest Jones—a list which is a sufficient guarantee of the standard aimed at.

The American Journal of Hygiene is published by the Johns Hopkins Press, and if the first number is any guide it promises to deal with the subject more from the pathological than the administrative standpoint. It is edited by William H. Welch, and contains five papers on parasitology and allied subjects. We learn from the introductory note that it is to be devoted exclusively to the publication of original research.

NOTES ON BOOKS

The second edition of Dr Whitfield's *Handbook of Skin Diseases and their Treatment* (Edward Arnold, 18s. net) maintains the standard set by the first, and includes the more recent advances in dermatology. Several new illustrations have been added, and the book should prove useful to students and general practitioners. While it is advisable to mention diseases such as pinta and blastomycosis, which have not been recorded in this country, one might have expected some notice of pellagra and sporotrichosis, both of which have occurred in Britain. In the chapter on syphilis the Wassermann reaction is discussed at considerable length, and useful advice given as to the interpretation of this test, while in that on lupus vulgaris the author insists strongly, and we think rightly, on the dangers of X-ray treatment of that disease. Treatment is, generally speaking, sufficiently detailed, while the references to X-rays and other specialised forms of treatment should serve to indicate when they are required.

We have looked forward to the appearance of the second edition of Dr Philip D. Kerrison's *Diseases of the Ear* (J. B. Lippincott Company, 35s. net). The main parts of the previous edition have been retained, and no great alteration has been made in the text. A new chapter is devoted to Barany's theory of the cerebellar control of joint movements, with a discussion of the relative values and importance of the pointing tests in vestibular as opposed to cerebellar diseases. A second contains a brief account of various

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types of deafness due to war injuries. The descriptions of the methods of testing, hearing, and the relative values of various tests are clearly given. A valuable section is that on the intra-cranial complications of middle ear suppuration, and useful hints are given with regard to the method of opening brain abscesses and the routes which should be taken by the exploring knife. Little notice has been taken of the auditory nerve tumours. This volume can be recommended to those students who desire to obtain a practical insight into the principles and practice of otology.

The alterations in the sixth addition of Dr Stitt's *Practical Bacteriology, Blood Work, and Animal Parasitology* (H. K. Lewis & Company, Ltd., 2os. net) vary from verbal changes to the interpolation of recent matter on vitamines in beriberi, and to the remodelling of the section on streptococci, and additional treatment of *B. influenzae*. The new index of laboratory procedures indicates the appropriate investigations for the various diseases and refers to the pages in the text where the methods are described. We need not detail further alterations. The book has a unique position, merited by the mass of practical detail presented, and the manner in which it is kept up to date.

Clinical Bacteriology and Hæmatology for Practitioners, by W. D'Este Emery, M.D., B.Sc. (H. K. Lewis & Company, Ltd., 15s. net), now in its sixth edition, is a practical presentation of the essentials of clinical pathology, and deals with bacteriology, hæmatology, and cyto-diagnosis. Valuable features are the insistence on proper collection of material for laboratory diagnosis and paragraphs on interpretation of results. To many the chapter on cyto-diagnosis will be most valuable as a practical presentation of a difficult but important subject.

The appearance of a third edition of *The Chemistry of Synthetic Drugs*, by Percy May, D.Sc. (Lond.), F.I.C. (Longmans, Green & Company, 1921, 12s. 6d. net), is a clear indication of its value, and to those wishing to refer the chemical constitution of various organic compounds it is a useful book of reference. The sketchy nature of the pharmacological statements, especially those dealing with recently introduced organic combinations, and the want of a clear statement as to the utility or otherwise of these makes it less useful to the medical practitioner than it might well be. The popularity of a preparation may be and in too many cases is due to the advantage of efficient advertisement rather than proved therapeutic value. A step towards the critical appreciation of drugs is gained by the comprehension of what it is, and Dr May's book gives valuable help in this direction.

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The new edition (fourth) of Dr Aitchison Robertson's *Manual of Public Health* (A. & C. Black, 10s. 6d.) presents in compact form all that a student requires to know of this subject. The early chapter on Meteorology should prove useful to D.P.H. candidates in lacking the overwhelming detail of most works on that subject. Dietetics cannot yet be called an exact science, but the necessity of salts of the vegetable acids is no longer admitted. Two vitamins are spoken of, but a third—anti-scurvy—seems to have come to stay. The treatment of Public Health in a separate volume is a great improvement, and the book will be useful to students in a hurry.

We have also received Dr Aitchison Robertson's *Manual of Medical Jurisprudence and Toxicology* (A. & C. Black, 12s. 6d.). It is not easy to condense such a subject into a small volume, but Dr Aitchison Robertson has successfully done so in his latest (fourth) edition. The book would be improved if signs and tests of diagnostic and conclusive value were more clearly distinguished from those which afford only general indications. In a book of this size it would seem better to describe only those tests for blood which are easy and conclusive. The description of spectra such as those of hæmatin which are difficult to obtain is unnecessary and confusing. The volume is remarkably complete.

The Manual for Health Visitors and Infant Welfare Workers, edited by Mrs Enid Eve (John Bale, Sons and Danielsson, Ltd., 10s. 6d. net), can be recommended as one of the best practical books upon Infant Welfare Work. It treats of all the aspects of Child Welfare Work in a broad and general way, and is full of sound common-sense. The chapter on County and Rural Health Visiting is particularly good, and the last chapter on The Tuberculosis Visitor is also excellent. The appendices deal with regulations for the training of health visitors, and give specimen schedules such as are required for the keeping of suitable records of the work performed by health visitors.

In *The Diagnosis and Treatment of Intussusception*, second edition (Henry Frowde and Hodder & Stoughton, 7s. 6d. net), Dr Charles P. B. Clubbe urges the importance of early diagnosis, and the key to this is "Listen to the mother's story and do not be misled because the child does not look desperately ill." Contrary to the usual practice, Dr Clubbe occasionally uses injection to reduce the intussusception back to the cæcum, preparatory to operation.

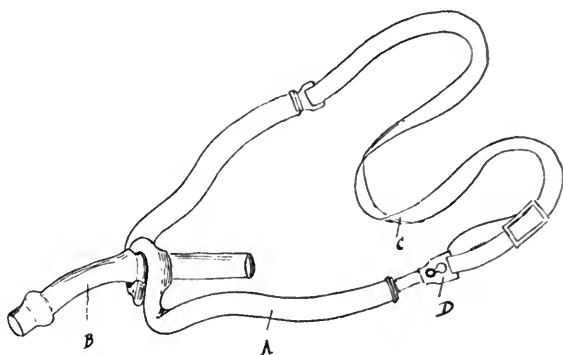
The book is sound and practical, and in its second edition should be read by every young practitioner.

A NEW APPLIANCE FOR THE THERAPEUTIC ADMINISTRATION OF OXYGEN.

By CHAS. G. STRACHAN, M.C., M.B., B.S. (Durh.).

IT is now admitted that oxygen as commonly administered by means of a glass funnel applied near to the mouth of the patient is practically useless in the treatment of anoxæmia. Haldane and others have shown that to do any good it is necessary to supply the oxygen in much greater concentration, and various methods, such as Haldane's face mask, the introduction of a catheter along the floor of the nose, etc., have been adopted to ensure this.

The simple appliance described below has been devised to permit of oxygen being administered continuously and in



considerable volume without the discomfort inherent in the use of the mask, which is objected to by many patients. It has been used with success in the Royal Infirmary, Edinburgh, and also in Chalmers Hospital, Edinburgh, and it was found that the most restless patient tolerated it.

It consists (see figure) of a malleable aluminium rod covered with rubber tubing A, which is bent into a loop at the centre, to engage a stout glass mouth-piece B. The glass mouth-piece, which can be readily removed for purposes of cleaning, is connected at its distal end with the oxygen cylinder. The covered aluminium rod rests lightly on the cheeks, and being malleable can be bent to fit any face. The patient has no sense of being gagged, as the loop holding the mouth-piece remains about $\frac{3}{4}$ inches from the lips. The whole is kept in

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position by an adjustable rubber band C, which passes above the ears and round the head of the patient to fasten on the left side with a catch, D.

This appliance is made by and can be obtained from Mr T. Miller, 44 Lauriston Place, Edinburgh, or Messrs Gardner, Forrest Road.

NOTES

At the Graduation Ceremonial in Medicine held in the M'Ewan Hall

**Graduation
Ceremonial in
Medicine.**

on 15th July 1921, the following degrees were awarded:—*Doctor of Medicine*.—G. A. Borthwick, M.B., Ch.B., 1913; T. L. Clarke, M.B., Ch.B., 1915; T. M. Davie, M.B., Ch.B., 1914 (*Highly Commended for Thesis*); A. V. Dill, M.B., Ch.B., 1916; F. P. Fouché, M.B., Ch.B., 1910 (*Commended for Thesis*); J. G. Greenfield, B.Sc., M.B., Ch.B., 1908 (*Gold Medal for Thesis*); R. L. Impey, M.B., Ch.B., 1915 (*Highly Commended for Thesis*); J. P. P. Inglis, M.B., Ch.B., 1905; N. S. R. Lorraine, M.B., Ch.B., 1915; H. M. Moir, M.B., Ch.B., 1913 (*Commended*); B. P. B. Naidu, M.B., Ch.B., 1913; R. H. H. Newton, B.A., M.B., Ch.B., 1913 (*Highly Commended*); P. J. Olivier, M.B., Ch.B., 1910; A. C. Renwick, M.B., C.M., 1898; W. G. Richards, M.B., Ch.B., 1916; William Stobie, M.B., Ch.B., 1908 (*Commended*); J. J. Thomson, M.B., Ch.B., 1908 (*Commended*); G. G. Wray, M.B., Ch.B., 1908 (*Commended*).

Doctor of Philosophy.—R. Kho Seng Lim, M.B., Ch.B.

Master in Surgery.—David Holmes, M.B., 1877.

Bachelor of Medicine and Bachelor of Surgery.—J. B. Aitken (*Second Class Honours*); G. J. Alexander; S. E. Ammon; T. F. Andrew; Flora T. F. Angler; G. R. A. Armstrong; C. W. Badger; F. E. L. Beck; Rosa M. Bickerton; J. M. Black; J. M. Bosman; W. H. S. Boyd; Maeve C. Brereton; A. S. Burns; D. I. Cameron; John Campbell; E. E. Candlish; E. A. Carmichael; Edith K. Chandler; J. H. Clarke; Jessie M'C. Craig (*Second Class Honours*); N. S. Craig; E. J. Crarer; Grace Cumming; E. D. Dingle (*Second Class Honours*); William Douglas; Alexander Dower; S. J. Eapen; G. D. English; H. D. Epstein; Isobel M. Finlayson (*First Class Honours*); E. M. Fraser; J. S. Fulton; Katharine M'L. Gifford; Elspeth L. Gilmour; Mary H. M. Gordon; Oliver Gray; Helen Gregory; Adele Haggart; A. A. Hamilton; Mary I. Hemingway; Henry Hodgson; N. R. H. Holmes; Helen R. T. Hood; Richard Howarth; J. W. A. Hunter (*Second Class Honours*); Jean F. Idde-

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kinge; F. T. Ingram; V. W. Jack; E. S. Jackson; J. D. Johnston (*Second Class Honours*); P. R. Kemp; Frans Krone; J. R. Larson; Laura M. Ligertwood; J. I. M'Caa (*Second Class Honours*); A. G. M'Clellan; Eliza W. M'Crae; Angus Macdonald; Agnes B. MacGregor; R. G. M'Intyre (*First Class Honours*); A. G. Mackay; D. E. Malone; Dorothea J. Mann; Margaret B. Martin (*Second Class Honours*); Nancy Martland; Aymer D. Maxwell; Isabella M. Mears (*Second Class Honours*); P. S. Meiring; C. E. Meryon; Mary Middlemass; Catherine A. J. Mitchell; Ruth M. Monro (*Second Class Honours*); D. M. Morison; Helen S. E. Murray; Jean Murray; Priya N. Nag; C. S. Nimmo; Marjorie Norris; O. A. Omololu; Carrick G. Payton; C. S. G. Pillai; Janetta J. Powrie; Mary E. Price; Margaret M. Proudfoot; Margaret T. Rutherford; Marjorie E. F. Sanders; Charles E. Scott; Hilda D. Scott; James Sharp; Louis Siff; G. J. Smit; M. T. Smith; H. W. J. Steen; Charles Stewart; J. D. Stewart; Jenny R. Tait; R. J. O. Taylor; E. K. R. Thomas; H. B. Thomson; Sophia M. R. Thomson; P. H. J. Turton; John Veitch; J. H. Verwey; T. J. M. Walker; D. C. Wilson; E. A. Wilson; Isabel G. H. Wilson; Hassan Zaifol.

Diploma in Public Health.—Harry Alexander, M.B., Ch.B.; A. F. Campbell, M.B., Ch.B.; Marjorie H. King, M.B., Ch.B.; Anne L. MacDonald, M.B., Ch.B.; Jane C. MacDonald, M.B., Ch.B. (Glas.); Annie S. MacLeod, M.B., Ch.B.; Henry J. Parish, M.B., Ch.B.; Austin Priestman, M.B., Ch.B.; Annie M. Roxburgh, M.B., Ch.B.; G. M. S. Smith, M.B., Ch.B.; Mabel Thomson, M.B., Ch.B.

The following awards of Fellowships, Scholarships, Prizes, etc., were made:—*Thesis Gold Medallist*.—J. G. Greenfield, M.D. *The Cameron Prize in Practical Therapeutics*.—J. J. B. V. Bordet, Director of the Pasteur Institute, Brussels. For important contributions to Bacteriology, Bio-Chemistry, and Chemo-therapeutics. *The Goodsir Memorial Fellowship*.—R. Kho Seng Lim, Ph.D., M.B., Ch.B. *The Straits Settlements Gold Medal*.—F. H. Stewart, M.D. (A/Lt.-Col., I.M.S.). *The Gunning Victoria Jubilee Prize in Medicine*.—R. L. Impey, M.D. *The Gunning Victoria Jubilee Prize in Anatomy*.—C. W. Stump, M.B., Ch.B. *The Ettles Scholarship and Leslie Gold Medal*.—A. L. M'Gregor, M.B., Ch.B. *The Allan Fellowship in Clinical Medicine and Clinical Surgery*.—J. I. M'Caa, M.B., Ch.B. *The Murchison Memorial Scholarship in Clinical Medicine*.—Jessie M'C. Craig, M.B., Ch.B. *The M'Cosh Graduate's and Medical Bursaries*.—E. A. Wilson, M.B., Ch.B. *The Beaney Prize in Anatomy and Surgery*.—A. L. M'Gregor, M.B., Ch.B. *The Mouat Scholarship in the Practice of Physic*.—R. G. M'Intyre, M.B., Ch.B. *The Conan Doyle Prize*.—A. L. M'Gregor, M.B., Ch.B. *The Annandale Gold Medal in Clinical Surgery*.—E. A. Carmichael, M.B.,

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Ch.B. *The Buchanan Scholarship in Gynecology*.—G. J. Alexander, M.B., Ch.B. *The James Scott Scholarship in Midwifery*.—Isobel M. Finlayson, M.B., Ch.B. *The Scottish Association for Medical Education of Women Prize*.—Isobel M. Finlayson, M.B., Ch.B. *The Dorothy Gilfillan Memorial Prize*.—Jessie M'C. Craig, M.B., Ch.B. *The Wellcome Medals in the History of Medicine*.—Gold Medal, J. M. Anderson; Silver Medal, T. Ferguson. *The Pattison Prize in Clinical Surgery*.—D. S. Middleton; A. J. Wilson—equal. *The Wightman Prize in Clinical Medicine*.—A. J. Wilson. *The Cunningham Memorial Medal and Prize in Anatomy*.—D. G. S. M'Lachlan. *The Whiteside Bruce Bursary*.—Donald Mainland.

The address to the graduates was delivered by the promoter, Professor Sir Robert W. Philip.

At an Extraordinary Meeting of the Royal College of Surgeons of Edinburgh held on 19th July, the President, **Royal College of Surgeons of Edinburgh.** Dr George Mackay, presented to the College a portrait of the late Lord Lister. The picture is a full-sized copy made by Mr Dorofield Hardy of the portrait painted by W. Ouliss, R.A., in the possession of the Royal College of Surgeons of England.

On the same meeting the following fourteen candidates, having passed the requisite examinations, were admitted as Fellows of the College. Fifty-six candidates entered for the examination. A. D. E. Bayliss, M.R.C.S. Eng., L.R.C.P. Lond., M.B., B.S., M.D. Lond.; K. P. Brown, M.B., Ch.B. Edin.; R. S. J. Fitzgerald, M.B., Ch.B. New Zeal.; Andrew Fowler, M.B., Ch.B. Aberd.; W. J. Grant, M.D., C.M. M'Gill, L.M.S., M.Co. P.E.I.; D. F. Hegarty, L., L.M.R.C.P. Irel., L., L.M.R.C.S. Irel.; Archibald Langwill, M.B., Ch.B. Edin.; J. J. Liston, M.B., B.Ch., B.A.O., N.U. Irel.; J. S. Robinson, M.B., B.Ch., B.A.O. Dublin; J. J. M'I. Shaw, M.B., Ch.B., M.D. Edin.; R. W. Smith, M.B., Ch.B., Edin.; Quintin Stewart, L.R.C.S.E. (Triple), L.D.S., R.C.S.E.; W. R. Stewart, M.B., Ch.B. Edin., Major I.M.S.; P. P. Wright, M.B., B.Ch., B.A.O., M.D. Belfast, D.P.H. Liverpool.

THE Examinations of the Board of the Royal College of Physicians of Edinburgh, Royal College of Surgeons of Edinburgh, and Royal Faculty of Physicians and Surgeons of Glasgow, were held at Edinburgh

**Triple Qualification
PASSES.**

in July. The following twenty-six candidates, out of seventy-nine who entered, passed the final examination and were admitted, L.R.C.P.E., L.R.C.S.E., L.R.F.P. & S.G.:—W. B. Stott, Aberdeen; E. S. Godlieb, Ceylon; O. P. Fox, New South Wales; J. H. Bain, Edinburgh;

Notes

V. H. L. Anthonisz, Ceylon; R. E. O'Keeffe, St Helens, Lancs.; J. S. A. Rogers, Melbourne; R. N. Nanda, India; Abdus Shakur, India; H. E. C. Cezair, Trinidad; James Pedris, Ceylon; A. C. Thom, Edinburgh; A. Y. Khan, Hamadan; E. J. Swirsky, Russia; J. M. Campbell, Edinburgh; D. M. Scrimgeour, Dundee; R. Abramsky, Moscow; Jane Copes, Ireland; E. W. Johnson, England; John Connal, Scotland; J. K. Holmes, England; Herbert Brown, England; A. W. Hart, Edinburgh; Hugh M'Kerlie, London; G. V. Jones, North Wales; and E. P. Dewar, Belfast.

THE following appointments have been made to the honorary staff of the Royal Infirmary:—

Appointments.

Dr Norman Walker to be physician for skin diseases for a further period of three years as from 5th October next; Dr Edwin Matthew to be an ordinary physician with the charge of wards for five years as from 1st October next; Dr Logan Turner to be surgeon consultant to the ear, nose, and throat department for three years as from 6th August next; Drs John S. Fraser and J. D. Lithgow to be surgeons to the ear, nose, and throat department, with the charge of wards, for five years each, as from the 6th August and 1st October next, respectively; Drs W. T. Gardiner and G. Ewart Martin elected assistant surgeons to the ear, nose, and throat department for probationary periods of two years each, as from 6th August and 1st October next, respectively.

BOOKS RECEIVED

- | | | |
|-----------------------|---|----------|
| BLACK, NORMAN. | Local Anæsthesia in Dental Surgery | |
| | (<i>John Bale, Sons & Danielsson</i>) | 5s. |
| COPE, ZACHARY. | Early Diagnosis of the Acute Abdomen | |
| | (<i>Oxford Medical Publications</i>) | 12s. 6d. |
| PUTNAM, J. J. | Addresses on Psycho-Analysis | |
| | (<i>George Allen & Unwin, Ltd.</i>) | 12s. 6d. |
| JONES, ERNEST. | Edited by. Psycho-Analysis and the War Neuroses | |
| | (<i>George Allen & Unwin, Ltd.</i>) | 7s. 6d. |
| MENZIES, K. | Autærotic Phenomena in Adolescence. Second Edition. | |
| | (<i>H. K. Lewis & Co., Ltd.</i>) | 5s. |
| MONRAD-KROHN, G. H. | The Clinical Examination of the Nervous System | |
| | (<i>H. K. Lewis & Co., Ltd.</i>) | 6s. |
| THOMSON, H. CAMPBELL. | Diseases of the Nervous System. Third Edition | |
| | (<i>Cassell & Co., Ltd.</i>) | 15s. |
| WRENCH, G. T. | Chavasse's Advice to a Wife. Seventeenth Edition | |
| | (<i>J. & A. Churchill</i>) | 2s. 6d. |

Edinburgh Medical Journal

October 1921

NOTES ON THE EPIDEMIOLOGY OF MEASLES AND INFLUENZA.

By J. W. CRERAR, M.B., F.R.C.S., Maryport.

I HAVE long thought that an explosive epidemic, such as measles or influenza, could be studied most easily in a relatively *small urban district*, where there is a sufficient population to supply a considerable number of cases, and where the conditions of life of the people are more or less uniform. In a *rural district*, the conditions are more varied and the population is scattered or in patches. In a *city*, the conditions of life are still more varied, the industries are diverse and disconnected, and there is more coming and going, more admixture with other communities.

An epidemic of *measles* occurred in Maryport in December 1914 and January 1915. It was not remarkable either for extent or for virulence.

In 1917, 6 cases were notified in April. In May and June no cases occurred. In July, one case, a lad of eighteen years of age, was under the care of my friend Dr Clark. Isolation was punctiliously observed, the younger members of the household went to the country, and immediately on convalescence the patient followed them. From the situation of the house in which this case occurred, and the subsequent distribution of the epidemic, it is highly improbable that the epidemic originated from this source.

On 25th July, a Mrs I—— with three children left London. She went to Barrow and thence on 28th July came to Maryport to live in a certain part of the town known as “downstreet.” There was already in the house where she came to live one child of six years who had not previously had measles. On 2nd August, *i.e.*, on the ninth day after leaving London, one of her children presented a typical picture of measles, with eruption, etc. Three days later a second child erupted. On 12th August

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her remaining child and the boy previously resident in the house erupted. Two of the children were gravely ill. In the third week of August a cousin of these children, living in a neighbouring street, was the next case and died from the disease. In September other cases occurred, almost (if not indeed) all in the "downstreet" part of the town. Subsequently the epidemic spread all over the urban district, rapidly increasing in extent and in virulence until it attained explosive dimensions in the first week in November. There can be little doubt that the epidemic originated from the imported cases already noted.

I had 160 cases under my care, and the bulk of these cases, viz. 117, erupted in the first three weeks of November. The explosive phase of the epidemic was confined to this period of three weeks. Seven deaths took place—a high percentage—4·4 per cent.

Before dealing with the more strictly epidemiological aspect of this investigation, attention is directed to the incidence of "complications" in the series of 160 cases.

Capillary Bronchitis	18 Cases.	Epistaxis	2 Cases.
Broncho-pneumonia .	8 "	Blepharitis (persistent)	5 "
Laryngitis	4 "	Parotitis (non-suppu-	
Stomatitis	4 "	rative)	1 "
Otitis Media	5 "	Endocarditis	0 "

The idea unfortunately is not confined to the laity that "it is not the actual disease which is so serious but the complications." Surely this conception is erroneous and harmful. Bronchial and conjunctival catarrh are as much essential manifestations of the disease as is the eruption. In the great majority of cases they are, like the eruption, but passing manifestations. It is true that few children die from the initial virulence of the morbillar toxæmia. It is equally true that people do not die from uncomplicated appendicitis. They die from septic peritonitis, from toxæmia due to periappendicular abscesses, secondary intestinal fermentation and the like, but who would say "it is not appendicitis which is so serious but the complications?"

The notion is widespread that measles is a relatively unimportant disease if the domestic surroundings be good and if, in the language of the older physicians, strict attention be paid to the regimen and nursing; and that capillary bronchitis and broncho-pneumonia, the chief causes of death in measles, are

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largely due to neglect in these particulars, and supervene as the child is recovering from measles proper.

All the serious cases I attended, including the seven children who died, were gravely ill almost from the commencement of the attack, and no differentiation could be drawn between the initial bronchial-catarrh and the onset of capillary bronchitis and (or) of broncho-pneumonia. The catarrh of the larger bronchi rapidly passed into the bronchioles and the alveoli. Broncho-pneumonia accounted for four of the seven deaths: death occurring on the fifth, eighth, tenth, and sixteenth days after eruption. In three no broncho-pneumonia could be discovered but extensive capillary bronchitis was present, and in one case laryngitis in addition: death taking place on the fourth, ninth and twelfth days after eruption. The domestic surroundings and general attention were good in four of these cases, fair in one case and very unsatisfactory in the case of the remaining two, both members of the same household.

I now revert to the more general considerations which, to my mind, arise out of a study of this epidemic, and I hope to be able to demonstrate by a comparison of various epidemics, particularly of the *age-incidence* and *time-distribution* of those epidemics, that a prima facie case is made out for a policy which would have important educational results and which, I consider, would be of some value in diminishing the ravaging effects of this disease on the invaluable child life of the country.

I recognise that no importance could be attached to my personal experience of this epidemic unless it were an index of the epidemic as a whole.

Through the courtesy of the acting Town Clerk I obtained the figures of the notifications (together with the ages) for the urban district for each week from 1st August to 31st December 1917, which period covered the whole of the epidemic, with the exception of a few cases in January 1918.

Notification of measles became compulsory on 1st January 1916. Not every case was to be notified but the first in the household, *i.e.*, each notification represents one household, irrespective of the number of cases in that household. As the number of my notifications was 102 and the total for the urban district was 440, it is clear that the curve of the latter reduced to one-fourth, *i.e.* 110, should closely resemble the curve of the former, if this were to be accounted a correct index. Graphs show how closely parallel they are, with the exception of

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the third week in November, when the urban district graph shows a rise not exhibited in the diagram of my notifications. This however is paralleled if my total cases be taken into account.

It is obvious that the cases erupting in the third week in November were infected sometime in the first week of November. The closure of the schools (of the infant schools on 7th November, and of the senior schools on 9th November) either had no effect on stemming the epidemic, or, if the fall at the end of third week be attributed to the closing of the schools, which was therefore a valuable health measure, then that measure should have been taken several weeks earlier.

There is no clear policy governing the closure of schools in the face of an epidemic of measles, and what health policy there may be is complicated by the question of the government grant, based on an average percentage attendance. If the average percentage attendance of a school fall below a certain standard, the Government grant is proportionately reduced. There is therefore too strong an inducement for educational authorities to keep the schools going so long as a fair attendance can be maintained, and when the elementary schools in a district are wholly closed on account of an epidemic of measles, a large number of the older children lose a considerable amount of education quite unnecessarily, and that too at an age when it is difficult, if not impossible, for that lost education to be made up.

Dr John Brownlee, in a paper on "Public Health Administration in Epidemics of Measles"¹ says:—"It is a general experience among middle-class parents that their children rarely take measles until the school age of the eldest begins. This is not so markedly the case with the working classes; among these greater facilities of infection are afforded by the children playing together in the street, for such a disease as measles is practically only spread by direct contact. In spite of this, however, in the opinion of a number of medical officers, the fire is lighted in the schools, and it is only then that streets and stair-heads become of importance as a means of spread."

I hope to adduce some evidence suggesting that the infant schools are responsible for the spread of the disease, and that only by dealing with them can it be hoped that "the absolute number of attacks of measles under five years of age should be very much smaller than it is" (Dr Brownlee, *ibid.*).

It is to be remembered that measles as a cause of death

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is confined chiefly to children under five years of age, and that "on an average about 11,000 deaths from measles occur in a year in England and Wales."²

In Maryport, young children between the ages of three to seven are admitted to infant schools; the age for compulsory attendance being five years.

In a typical infant school, 53.6 per cent. of the children were under six years of age, and 44.4 per cent. between the ages of six and eight years. A certain number of children under eight years attended the senior school.

Attention may now be directed to the *age-incidence* of measles in the recent epidemic in three districts of West Cumberland, two urban, and one rural. For the Harrington figures I am indebted to Dr Cullen, M.O.H., and for the figures of the Cockermouth Rural District to Mr Jackson, the Sanitary Officer:—

Of my Cases:—

86.2 per cent. were under 6 years of age.

95 " " 8 " "

98.7 " " 10 " "

Maryport Urban District notifications:—

84 per cent. were under 6 years of age.

97 " " 8 " "

97.7 " " 10 " "

Harrington Urban District notifications:—

67.6 per cent. were under 6 years of age.

94.1 " " 8 " "

98 " " 10 " "

Cockermouth Rural District notifications:—

60.5 per cent. were under 6 years of age.

82.6 " " 8 " "

93 " " 10 " "

The conspicuous features of these figures are:—(i.) the high percentage under six years in the Maryport epidemic, viz., 84 to 86 per cent.; (ii.) the small proportion of cases in Maryport and Harrington over eight years (3 to 5 per cent. in Maryport, 6 per cent. in Harrington); and (iii.) the higher ages in the Cockermouth Rural District, where a relatively small proportion of children go to infant schools.

A happy chance put me in possession of the reports of the

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Whitehaven Dispensary for the early years of the nineteenth century, and I am enabled to illustrate the age-incidence of two epidemics of measles at that time. That they were genuine epidemics of measles, and not of German measles, is evident from the statements made in the reports. I may be permitted to quote from these reports. Of the 1802-1803 epidemic it is stated: "In all extensive communities the acute diseases peculiar to children are always the most numerous and important. Of these, the measles constitute a large proportion, and in our northern climate this specific contagion appears to be highly distressful and dangerous, not only in the urgency of its present symptoms, but from the tedious and painful distempers which so frequently succeed. No disease has been lately so prevalent within the district of this Charity, the present annual admissions amounting to 267, though few instances of it have occurred these last two years. Its origin could not be traced with any certainty. . . . It continued to prevail during the summer in a form so mild, as rarely to require medical assistance. The moist and cold weather of the autumn and winter did not render the inflammatory and catarrhal symptoms of the disease more powerful, though its objects were considerably increased. . . . A few children upon the third day, when the eruption began to recede, suffered internal determination, chiefly to the throat and lungs. . . . Blood-letting and blistering with antimonials were, in these cases, the only means of relief and recovery. . . . The irritation to cough was allayed by the occasional use of pectorals and opiates. Strict attention was paid to the regimen of the sick. Mucilaginous and cooling articles of diet were directed, and the accession of the external air was cautiously guarded against. The cases of fatality (two in number), noted in the systematic arrangement, occurred in the month of February." Of the 1806 epidemic (the year of the death of Pitt), it is stated: "The only other prevailing contagion is the measles, which was introduced into a confined and sordid situation, two months ago, by the child of a mendicant traveller. We are sorry to observe that the disease has since very rapidly diffused its malignant influence, and threatens to become an alarming malady." Subsequently, it is stated: "The measles, which appeared in the month of February 1806, have raged with considerable virulence during the summer and autumn. The deaths and recoveries were in the proportion of 10 to 386."

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It is of importance to observe that both these epidemics were spread over a considerable part of a year, a feature which, along with the higher age-incidence of the disease, probably accounts for the low mortality, viz., 0.7 per cent. in the first epidemic and 2.5 per cent. in the second.

As compared with the Maryport epidemic, the Whitehaven epidemics agree with the epidemics in Harrington and in the Cockermouth Rural District in the relatively smaller proportion of children affected between the ages of two and five years, viz., 31 per cent. (of all cases under fifteen years) in the 1803 epidemic, and 40.8 per cent. in the 1806 epidemic. The corresponding figures for Harrington and the Cockermouth Rural District being 41.8 per cent. and 36 per cent. respectively. The corresponding figures for Maryport are 52.4 per cent. of the urban district notifications, and 53.1 per cent. of my total cases.

Maryport is the most densely populated of these districts: the census for 1911 giving for Maryport 11,418 people to 1515 acres—a typical small urban district. Harrington, another small urban district, where the industries are similar, had 4338 people to 2390 acres. Cockermouth, a typical rural area, had 22,231 people to 162,783 acres.

As it is not possible to know how many cases of measles occurred, only the "households" being notified, I have taken the proportion of my total cases to the number of my notifications as an estimate of the total cases in the various districts. Roughly speaking, I had 60 per cent. more cases than notifications. Increasing the number of notifications by 60 per cent., the following figures are arrived at:—

Maryport Urban District—

440 notifications + 60 per cent. = 704 cases.

32 deaths; case mortality 4.5 per cent.

Harrington Urban District—

178 notifications + 60 per cent. = 284 cases.

1 death; case mortality below 0.5 per cent.

Cockermouth Rural District—

258 notifications + 60 per cent. = 412 cases.

4 deaths; case mortality 1 per cent.

Compare with the Whitehaven epidemics—

1802-3. 267 cases, 2 deaths = case mortality 0.7 per cent.

1806. 396 cases, 10 deaths = case mortality 2.5 per cent.

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certain that the loss of child life through measles would be greatly diminished. Does the aggregation of young children in schools, when measles has been introduced into a district, not tend to the more rapid propagation of an epidemic, and to their infection at an age when they are more liable to a fatal issue?

Of five children (four to five years of age) attending a certain infant school, who came under my care in the first fortnight of November 1917, three died and the other two were so seriously ill that I entertained but little hope of their recovery. Of these children, one erupted on the third day after her last day at school, one on the seventh day, one on the eighth, and two on the twelfth day after the last day at school. I know of another child attending the same class at the same time who died on the eleventh day after her last day at school. Of these six children, four are dead.

The explosive commencement of the Harrington epidemic at the beginning of the Christmas holidays 1917, indicates the probability that the schools were the locus of infection.

Another epidemic of measles in Maryport, mild in character, extending from October 1919 to April 1920, affords some confirmation of the opinion that the infant schools are not without responsibility for the spread of the disease. Notification of measles having ceased on 31st December 1919, I am unable to control my personal observations by reference to the cases in the district as a whole. Confirmation, however, is obtained by reports from the head teachers of the various schools. The epidemic never became virulent, and the sporadic fires were not lost in the onrush of a prairie fire conflagration, as happens in an explosive epidemic.

The bulk of the cases at any given time were almost exclusively associated with the children attending one school only. The diagram shows that the Nelson Street infant school was the first involved, in October and November 1919. After the Christmas holidays, from the middle of January to the end of February, almost all the cases were associated with the Camp Road infant school. In March the George Street and Grasslot infant schools became involved.

The head teachers of the various schools report as follows:—

Nelson Street School—

“About 30 cases, latter part of October and November.
No cases since Christmas.”

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Camp Road School—

“40 cases last week of January to second week of March.”

George Street School—

“20 cases, third week of February to the third week of March, the school being closed on account of the epidemic on March 24th.”

The Mother Superior of the R.C. school informs me, that, “with ninety-six children on the roll of the infant school, only three cases occurred, two in November and one in December, and no fresh case after the Christmas holidays,” and this, be it observed, despite the fact that the majority of the children attending this school reside in that part of the town where the Nelson Street school is situated. There can be little doubt that, in this epidemic, infection took place in the schools and not in the streets.

In connection with our public elementary schools, there are three considerations which present themselves to the school authorities with regard to epidemics:—

1. Life and health.
2. Education.
3. Finance.

Of these, the first is far and away the most important, and neither the first nor the second should be dependent on the third. There should be no temptation for the school authorities to keep the attendance as high as possible in view of average attendance grants, where there is even a probability that life and health may be endangered. And surely something is wrong when children who should be continuing their education are excluded from school because the authorities obtain a larger grant when the school is empty than when it and the teachers are being devoted, even partially, to their essential purposes.

I venture to suggest that there is at least a *prima facie* case for a policy which, on *grounds of health*, would close the infant schools and exclude children under eight years of age in urban districts (under ten years of age in rural districts) from school, so soon as a sufficient number of cases of measles occur in a district to suggest that an epidemic is imminent; and *on grounds of education* would keep the senior schools open to allow of the older children continuing their school attendance.

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Dr Cullen, M.O.H. for Harrington, with whom I discussed the problem along these lines on 21st December 1917, informed me that he carried out this policy during the epidemic which occurred in his district, shortly after the Maryport epidemic had subsided. The Harrington epidemic extended from 26th December 1917 to about the middle of April 1918. He writes as follows:—"On receipt of the first half-dozen notifications (*i.e.*, after the Christmas holidays), all being under six years of age, I thought it advisable to close the infant schools, as a matter of precaution, which was done—owing, however, to the junior school being in the same building, I thought it advisable to close this also. In the infant school the children are between five and seven years of age; at the junior school the children are between seven and ten years; so that by closing the latter I raised the exclusion age to ten years, which I considered too high. I would really have liked to have kept it to eight years and under, and you will see by the figures quoted that 'eight years and under' would have been about correct. The senior schools and the R.C. schools were left open. I did not exclude any children, whether they had had measles or not, from these schools, even if measles were in the same house, but tried to get the parents to isolate the patients at home as well as possible.

"The infant and junior school was closed from 7th January to 1st February inclusive."

The age-incidence at Harrington has already been referred to.

"The average attendances of the older children for the two weeks preceding the epidemic were 85.57 per cent. and 79.67 per cent. respectively. The Christmas holidays then intervened. For the subsequent weeks the average attendances were, 80.56 per cent., 84.66 per cent., 83.17 per cent., 87.17 per cent., and 88.87 per cent. Only one case of measles occurred in the senior school during the period of the epidemic. I am glad to say we had only one fatal case, *viz.*, an infant nine months—pneumonia."

Both as regards life and education the Harrington experiment would appear to be encouraging, and affords some support to the belief that even a potentially explosive epidemic can be subjected to control.

Having dealt with measles, chiefly in its relation to school attendance, attention may be directed briefly to a *comparison of*

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the epidemic of measles in 1917, with the calamitous epidemic of influenza in October, November and December 1918.

There are points of resemblance, both clinically and statistically, which are at least suggestive. Both were virulent, and in both the so-called complications were integral features of the diseases, at least in the extending or upward phases of the epidemics. I think it will be agreed, as a matter of general observation, that in a virulent, explosive, apparently self-determining epidemic, the patients who are affected as it is tending towards its climax are more seriously ill than those who are affected as it is declining. Certain it is that, in the two epidemics I am reviewing, my personal experience was that so-called complications were much more frequent and grave in the earlier weeks than in the later weeks of the epidemics. It is significant that of my fatal cases (7 from measles and 14 from influenza), with the exception of one case of influenza, all were infected in the ascending phase of the epidemic, assuming twelve days' incubation for measles and three days for influenza.

There was much similarity in the clinical pictures of those gravely ill with pulmonary complications, whether the initiating disease were measles or influenza. Can this similarity be dependent on the presence of a similar secondary infection in both cases? Bacteriologists seem to be agreed that the presence of the pneumococcus and the streptococcus was a common finding in cases of acute influenzal pneumonia, and Dr Thursfield has shown "that streptococcal infection was a preponderant cause of death in measles."³

Is it not probable that the fulminating virulence of the primary infection, whether it be measles or influenza, is the occasion of the activity of the other micro-organisms, and that it is unnecessary to invoke the theory of a simultaneous mixed-infection? Does the devitalising depression of the original infection not present the opportunity for a sudden acquisition of virulence on the part of microbes which may be normal inhabitants of the throat and nasal passages?

Both epidemics presented the same rapid rise to a climax and are even more remarkable in the suddenness of their fall. The course of the epidemics would suggest that the virulence of the infecting agent is rapidly attenuated in its passage through the bodies of hosts with normal immunity, and that it soon loses its power to kill or even to infect specifically. If

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this be true, it is not difficult to understand the complete failure of the attempt to exterminate the rabbits in Australia by microbial dissemination.

It is probable that in a city, constant reintroduction of fresh virulent strains complicates the more simple incidence of an epidemic as experienced in a small urban district, and that, even in the latter, the progressive attenuation of the virus would be interrupted and a fresh explosive phase initiated were a fresh virulent strain introduced.

Does the character of an infectious epidemic, as regards mildness or severity, not depend on whether or not certain very susceptible subjects, with under-average immunity, become infected, with consequent acquisition of virulence on the part of the infecting microbe?

It is probable that in a much "salted," highly-organised community, such as that of Britain, such subjects with under-average immunity are relatively rare, and that environment has something to do with the acquirement of a higher general immunity. Such acquired immunity is not likely to be of high degree in the case of young children, among whom under-average immunity is probably more common, hence the frequency of virulent measles epidemics and the high annual death-rate therefrom.

It is a matter of general knowledge that, as regards certain diseases, some races of mankind exhibit a very low degree of immunity. An extremely interesting recital, given to me by a friend, has some bearing on this question. It is known that, in England, the June influenza epidemic wave was much milder than the October-November wave. For the people in Britain, at any rate, the epidemic (and therefore the organism or organisms) was not so virulent. Deaths were not common.

On 16th June 1918, an Eastern liner, converted into a troop ship, sailed from Newcastle for Murmansk. There were 700 white troops on board and about 250 of a crew, the firemen, deck-hands, etc., being Lascars. The ship reached Murmansk on 23rd June. On the voyage there were many cases of influenza among the troops, and of these about twelve were sufficiently ill to require transference as stretcher cases to a camp hospital on 26th June. Of these cases one died—the only white death. Among the Indians, influenza appeared almost as soon as the boat put to sea, and by the third day out all were sick and none were working. Of these cases ten were buried

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at sea, and six more died within a few days of arrival at Murmansk.

There is a striking contrast here between the effect of the epidemic on the white and on the black people which cannot be accounted for by any seasonal difference in the virulence of the infection.

Is it not probable that the virulent character of an epidemic may be determined by a relatively small number of subjects with low-grade immunity, who act as intensifiers of the virus and that the course and close of an epidemic may be determined by the rapid attenuation of the virus in passing through subjects with normal immunity?

REFERENCES.—¹ *Brit. Med. Journ.*, 17th April 1920, p. 534. ² *Memorandum by the Medical Officer of Local Government Board*, November 1915. ³ *Report of Medical Officer of Local Government Board*, 1912-13.

STILL-BIRTH: ITS CAUSES, PATHOLOGY, AND PREVENTION.

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(Working under the Medical Research Council.)

(Continued from page 166.)

V. Syphilis.

Out of the 200 cases of still-birth and early infantile death there were 35 cases in which death was due to syphilis, or 17.5 per cent. Fourteen of these have been already classified under maceration. The remaining 21 were cases of neonatal death, the duration of life varying from a few moments to 42 days; most of the deaths occurred, however, at about the end of the first week.

Obstetrical History pointing to Syphilis.—Excluding 10 cases in which the mother was a primipara, of the remaining 11 cases there was a history of miscarriages or repeated neonatal deaths in 7.

Signs of Active Syphilis in the Mother.—Only in 3 cases of the 21 were there any signs of active syphilis in the mother, such as sore throat, condylomata, etc.; none of the other 18 gave any history of previous clinical signs of syphilis, or of infection.

Wassermann Reaction.—This was strongly positive in 5, negative in 7, not obtained in 7; doubtfully positive at the 5th month, twice negative again before birth in one, and in the remaining one the cord blood was negative, but the mother's blood was weakly positive 16 days after delivery.

Antenatal Treatment.—Only two of the mothers had undergone specific treatment during pregnancy, and in both cases this was inadequate. One came under observation at the 5th month, and was delivered at the 7th month of a child whose organs showed well-marked syphilitic changes. During the 2 months she had received five injections (1.5 g.) N.A.B. intravenously besides mercury and tonics. The other case came under observation at 6½ months; she had condylomata and sore throat and a strongly positive Wassermann. She had only received two injections of N.A.B. when she gave birth to a premature child, which showed marked syphilitic changes in the organs.

The effect of early and thorough treatment of the mother was well seen in the case of an infant not included in the present series. The mother, at the beginning of her pregnancy, had a strongly positive Wassermann with signs of secondary syphilis. After treatment the reaction was negative at the 7th month, the cord blood was

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and was jaundiced from birth, there were very marked hæmopoietic changes in the liver. In a well-marked case of fine cirrhosis, which was unassociated with periportal, there was no jaundice whatever.

Chondro-Epiphysitis.—Only one of the fresh fœtuses showed definite chondro-epiphysitis, and in this the joints were disorganised and filled with pus. In two other cases its presence was so indefinite as to be useless in diagnosis. I have ceased to place any reliance upon the *absence* of this sign in the exclusion of syphilis in the fresh fœtus.

Presence of the Spirochæta Pallida.—While of 14 macerated syphilitic fœtuses the spirochæte was found in 8, amongst fresh fœtuses it was only found in 1. The child in this isolated case had been born at the 8th month, and only gasped a few times. The lungs showed, even to the naked eye, a very marked degree of pneumonia alba. This absence of the spirochæte was particularly unexpected in one case where twins were born at 7½ months. The first was born macerated, and spirochætes were very numerous in all its organs, including the wall of the heart, the uterus and Fallopian tube. The other twin lived for 16 days and then died of catarrhal pneumonia, the lungs also showing very well-marked *interstitial* pneumonia, and the liver an early cirrhosis. Both infants were females; the placentas were separate, that of the macerated fœtus being, of course, much more avascular than that of the other, though the latter was much less vascular than normal. It seems impossible to avoid the conclusion that the spirochæte goes through a definite sexual cycle. Only on this assumption can its repeated absence in proved syphilitic fœtuses be explained.

Thyroid.—In 4 of my cases the thyroid gland was the seat of fibrosis. The newly-formed fibrous tissue pressed upon the acini, so that the latter were in most parts destroyed, only a few cells remaining amongst the strands of fibrous tissue. In other parts less destruction of the acini had occurred, but the lumen was filled with proliferated cubical cells derived from the lining layer, closely fitting into each other and generally vacuolated. In some acini a little colloid could be seen amongst these cells, in others the proliferated cells entirely filled the lumen, and no colloid was visible. Very few normal acini were left, and the blood vessels had their walls much thickened.

This thyroid fibrosis seems to have no necessary relationship to the interstitial changes in the thymus, as in one case there was a well marked though patchy change in the thyroid, while in the thymus fibrosis and even proliferation of the reticulum cells were entirely absent. An interesting question arises as to what alterations would have resulted in the development of the child had it survived. Would symptoms of cretinism have become evident, or would the gland have become degenerated, and new secreting tissue formed

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under specific treatment? In the normal foetal thyroid, groups of cells exist amongst the acini which develop later into fully-formed acini. In the fibrotic thyroid of syphilis, fair numbers of these potential acini still remain, and would, no doubt, under specific treatment, develop into acini producing sufficient colloid to meet the needs of the growing infant.

Thymus.—The thymus gland in syphilis presents no unusual naked eye appearances except in cases where there has also been marasmus. The gland is then small, usually weighs no more than 1 or 2 grms., and is dark red in colour, and little or none of the normal "thymus milk" can be squeezed from its cut surface.

Microscopically, the following changes were found:—

1. *Alterations in the Corpuscles of Hassal.*—In a well-marked case of thymus syphilis these may be larger than normal, and are not confined to the medullary portion of the lobule, but are also numerous in the cortical area immediately underneath the capsule and interlobular septa. It is probable, however, that in marasmus the cortical part of the lobule has to a large extent disappeared, and that the medulla alone composes the entire lobule. In addition to this increase in size, the individual corpuscles were replaced by leucocytes, chiefly polymorphs and granular debris. These changes were especially well marked in one of my cases where practically no normal corpuscles were left. (See original paper for further details.)

2. *Increase in Plasma Cells* was very marked in some of my cases. They occupied the spaces formed by the network of branching reticulum cells which are normally occupied by lymphocytes. They would seem to have replaced the lymphocytes, very few of which were present.

3. *Increase in Reticulum Cells.*

4. *Fibrosis.*—This seemed to arise entirely from thickening of the capsule and trabeculae, and of the walls of the smaller and larger vessels. So far as could be observed there was no tendency on the part of the reticulum cells to form fibrous tissue.

Lung.—In only one case did the lung present the typical naked eye appearance of pneumonia alba. In all the other cases the lungs, apart from interstitial hæmorrhage, which was present in two cases, or a terminal œdema and congestion of the lower lobes, presented no abnormal naked eye appearance, and it was only on histological examination that the true condition of the lung was revealed. The histological changes present were briefly as follows:—

1. *Thickening of the Pleura.*—This was present in only a few cases: it tended to be irregular, and more marked at some parts than others.

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2. *Thickening of the Alveolar Walls.*—The most common change found. It must not be mistaken for the thickening due to congestion and œdema. The tissue forming it is cellular, with a very fine stroma. The cells vary, some resembling lymphocytes or plasma cells, while others are large, flattened epithelial cells of irregular outline and contain pigment. Capillaries are few as compared with the normal.

3. *The Alveoli.*—In well-marked cases these were few in number, chiefly on account of the enormous thickening of the alveolar walls. Those that are left were usually loosely fitted with catarrhal epithelial cells of irregular shape and containing pigment. These phagocytal cells are derived from the endothelial lining of the alveoli, the cells of which, even when still *in situ*, also contain pigment. The alveoli also contain granular debris, and a few red blood corpuscles, mostly without pigment.

4. *Thickening of the Walls of the Blood Vessels and Bronchioles.*—This was less constantly found, and did not appear to have any relationship to the thickening of the alveolar walls, that is, the latter might be present and the vessels appear to be normal. When present it appeared to be entirely of the medial and adventitial coats and to be confined to the vessels of the interlobular septa, not affecting the capillaries of the alveolar walls. These, however, were mostly obliterated by the cellular proliferation.

5. *Presence of Miliary Gummata.*—In only one case were miliary gummata found on microscopic examination. The nodules were circumscribed, but with no connective tissue capsule, and in them the following types of cells were found :—

(a) Lymphocytes (numerous).

(b) Plasma cells (numerous).

(c) Large cell, probably of endothelial origin, irregular in shape and with large vesicular nucleus.

(d) Very few polymorpho-nuclear leucocytes.

No gummata, either in this case or in any other, were recognised on naked eye examination.

6. *Massive Interstitial Hæmorrhages.*—Many cases of congenital syphilis seem to have a tendency to hæmorrhages in various organs. This is well illustrated by a case in which the child was born at the 7th month and was blue from birth. It died on the 2nd day, and the lungs, at post-mortem examination, were found to be the seat of massive interstitial hæmorrhage, involving the greater part of the lung substance. The blood was found to fill the alveoli and bronchi, so that practically no air-containing alveoli remained. Some of the blood appeared to be fairly old, as if the effusion had taken place during birth, but most was fresh, and had apparently been shed

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just before death. One may frequently see where the vessels have given way, but it does not appear to be preceded by any aneurismal dilatation of the vessel wall, and is probably due to a general weakening of the vessel wall by the action of the syphilitic toxin. In another case, in which the child died suddenly on the 12th day without previously presenting any unusual symptoms except slight jaundice, there was found to be extensive hæmorrhage in the kidneys, starting in the pyramids and spreading into the cortex. In addition to these there were 3 cases of extradural hæmorrhage in the spinal cord, the blood having apparently been shed just before death. It was thought that these hæmorrhages might be explained by prolongation of the coagulation time of the blood, but investigations have so far failed to bear this out.

Liver.—Only rarely was any naked eye change in the liver observed. Generally, it was not at all increased in size or weight, but in one or two cases it was so. In only one case was there any undue toughness of the liver, which was perfectly smooth, but the toughness was at once apparent, and there was deep bile staining. Microscopically, the condition was one of very marked periportal cirrhosis.

In my cases the following types of liver change were distinguished:—

1. *Periportal Cirrhosis.*—This was the commonest change, and was present in half the cases. In the portal tract the following types of cells could be distinguished:—

- (a) A few lymphocytes.
 - (b) Fairly numerous plasma cells.
 - (c) Large elongated or oval cell containing coarse eosinophile granules, and without a definite cell wall.
 - (d) Fibroblasts and connective tissue cells.
- A, b, and d are probably successive stages of the same cell.

2. *Intercellular or Fine Cirrhosis.*—Present in 3 cases, in one of which it existed alone, in two others combined with a periportal cirrhosis. Both in this and the periportal type there was more or less fibrous thickening of the wall of the hepatic vein in the centre of the lobule.

3. *The Hæmopoietic Type.*—In this there may be no cirrhosis, either periportal or intercellular, but the sinusoids are filled with large numbers of cells of various kinds, chiefly lymphocytes—a combination and exaggeration of the blood-forming function of the liver found during foetal life. It was well marked in 5 of my cases, and in the sinusoids the following cells could be distinguished:—

- (a) *Mesamæboids.*—Large cells resembling liver cells in general appearance and staining reaction, but smaller. They may

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contain only one deeply staining nucleus, but frequently the latter was multilobed. These primitive cells divide and redivide rapidly and form the—

- (b) *Large Lymphocyte*, resembling the large lymphocyte of the normal blood.
- (c) *Eosinophile Cells*.—There were a few of these present, and they commonly lay in groups of two or three. They are large, like myelocytes of bone marrow, and always contain a perfectly rounded nucleus and large coarse eosinophile granules in the protoplasm.
- (d) Only a very few nucleated reds were present, and this formed one of the most striking differences from the normal liver of the early fœtus.

The condition then seems to be a continuation and exaggeration of the normal blood-forming function of the liver found in early fœtal life, with the difference that the new cells formed are almost entirely of the colourless type. The excess of lymphocytes present is confined to the sinusoids, and was not found in the central hepatic vein nor in the vessels of the portal canal or those of other organs.

4. *Cirrhosis combined with Atrophy of the Central Zone of the Lobule.*

—This was marked in one case, and was there associated with a periportal and fine cirrhosis. The liver cells around the central vein were degenerated, their outline faint, and the cell body granular and faintly staining, so that frequently no definite cells could be made out.

Kidney.—In only one case was any abnormality observed in the kidneys; this was Case 141, in which the child, a premature one, died suddenly on the 11th day without previously exhibiting any unusual symptoms, except some jaundice.

Both kidneys were, on section, seen to be hæmorrhagic, the extravasated blood being confined to the pyramids and giving them a very dark red appearance, as compared with the normal cortex. It was remarkable that the hæmorrhagic area was strictly limited to the pyramids and not all of them were affected, one or two in each kidney remaining apparently normal.

Microscopically.—The most marked feature was the presence of extravasated blood in the medulla. It was strictly confined to the pyramids, except here and there where it extended into the cortex, along the narrow zone, immediately surrounding some of the medullary rays; this was, however, very slight and was not apparent to the naked eye. The blood was situated amongst and between the tubules, but was never found inside them. The collecting tubules, however, contained an opaque, faintly eosinophile fluid, and occasionally a little of this could be observed in the intertubular tissue.

The kidney, as a whole, was considerably congested, this being

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especially well marked in the capillaries of the glomeruli. The cells lining the tubules were swollen and granular, and in many were desquamated, although the latter may have been due to post-mortem changes. At the junction between the cortex and medulla, two moderate sized veins were found containing thrombus. In neither case did the thrombus seem very recent, while in one it was distinctly laminated and adherent at one side to the wall of the vessel.

The condition would therefore appear to be one of infarction due to thrombosis of certain of the venous arches between the pyramids and the cortex. The absence of hæmorrhage in the cortex is probably accounted for by the free anastomosis which takes place between the cortical capillaries of adjacent interlobular vessels and by the collateral circulation between the cortical vessels and those of the capsule.

Nothing could be discovered at the site of the thrombus to account for the thrombosis in the two vessels affected, such as disease of the tunica intima, and in neither was any abnormal thickening of the vascular coats generally apparent.

In the vessels in other parts of the section, however, particularly the arterioles, there was marked thickening of the tunica adventitia and also of the tunica intima, so that the lumen in some cases was almost entirely obliterated. In one instance a small arteriole seemed to be entirely obliterated by a cellular proliferation of the tunica intima or endothelium. This vascular thickening was very pronounced in the thyroid and thymus, and in these organs was associated with a generalised fibrosis. In the kidney, however, there was no generalised fibrosis present. One or two necrotic glomeruli were found in the cortex.

Pancreas.—There were several cases in which there was well-marked fibrosis of the pancreas, young fibrous tissue making its way between the acini and destroying them. It was remarkable that the Islands of Langerhans seemed to be increased in number. In the normal pancreas of the young infant Islands of Langerhans are only seen with difficulty and after somewhat prolonged search, but in the fibrotic pancreas of the syphilitic infant there were frequently found as many as ten in the microscopic field with a third objective. Is it possible, then, that the so-called Islands of Langerhans are merely a stage in the development of the normal acini of the pancreas, and that their increased number in the fibrotic pancreas points to an attempt at acinus formation?

Spleen.—Splenic enlargement, one of the most reliable signs of syphilis in the new-born infant, was present in only five cases, the weight in these varying from 55 to 16 grms. The organ was generally firm with rounded edges, but in one case was noticed to be unusually flabby.

The enlargement was in every case associated with cirrhosis of the liver, and seemed to be quite independent of the density of the reticulum of the spleen itself. Where the cirrhosis was early and commencing

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only, the size of the spleen was but little altered, and where, on the other hand, the liver changes were well marked, a corresponding increase in the size of the spleen was found. In the six cases in which the liver was normal the spleen had undergone no increase in size. (For details see original paper.) In only one case was a small spleen associated with well-marked cirrhosis. In this the cirrhosis was a combination of the periportal and fine types, and therefore one would have expected a marked enlargement of the spleen, but the latter was much fibrosed, its capsule was markedly thickened, and strands of fibrous tissue ran here and there throughout the organ. At the same time, the walls of the vessels were thickened, and many of the Malpighian corpuscles were entirely, or almost entirely, obliterated. The effect of this vascular change would be to diminish the amount of blood circulating in the organ, while the fibrous change, together with the thickening of the capsule and trabeculæ, would prevent expansion and enlargement by the hyperæmia consequent upon the cirrhotic change in the liver.

In all the cases of enlargement except one the spleen was markedly hyperæmic. In the exceptional case, the liver was the seat of fine cirrhosis only; the capillaries and sinuses of the spleen pulp were dilated, but almost entirely empty, and the reticulum of the spleen was extremely loose, with few cells present in the meshes.

1. *Histological Appearances of the Spleen.*—The Malpighian bodies were frequently much diminished in size and number, and this seemed to depend upon the obliterating endarteritis and thickening of the tunica adventitia so often met with in syphilis of the spleen.

2. *The Plasma Cells.*—All sections were stained with methyl green, pyronin, and resorcin, and compared with numerous sections of normal spleen, adult and foetal. The result was that in the normal spleen the number of plasma cells seemed to vary considerably. In some there was only an occasional plasma cell present, in others these were fairly plentiful. In one or two syphilitic spleens they were more plentiful than in any of the normal cases (adult or foetal), but the increase was by no means marked or characteristic.

3. *The Reticulum Cell.*—The number of these also varies within wide limits in the normal spleen. No characteristic increase was observed in congenital syphilis, and in many of the cases they were scarce and isolated, even where the spleen was enlarged. Increase of plasma cells or of reticulum bore no relationship to the size of the spleen, neither did the number of plasma cells bear any relationship to that of the reticulum cells. There is no reason to think that the reticulum cells form fibrous tissue, and in the cases where the spleen was fibrosed this seemed to be due entirely to thickening of the tunica adventitia of the arterioles, and of the capsule and trabeculæ.

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(For detailed histology of the spleen in the syphilitic and normal cases, see original paper.)

From this study it was apparent that only in one or two syphilitic cases was the number of plasma cells fairly large; in one of these (Case No. 12 in tables) the spleen weighed 55 grms. The number of plasma cells present could, of course, have nothing to do with this enlargement, as they would not number more than two or three in an oil immersion field and in some fields might be entirely absent. The reticulum in this case did not seem increased in density, and the great change present was dilatation and congestion of the sinuses in the pulp. On the other hand, in a case associated with fine cirrhosis in the liver, in which the spleen weighed 22 grms., reticulum was scarce, plasma cells very few, and the sinuses, though they seemed somewhat dilated, were almost entirely empty. In two other spleens in which the definite enlargement was present the plasma cells were very few, no more plentiful than in normal spleens, and much less than in one of the normal adult spleens.

It seems thus legitimate to conclude that the *splenic enlargement is of the nature of a hyperplasia, and is independent of the number of reticulum and plasma cells present and of hyperæmia.*

Post-mortem Diagnosis of Syphilis.—In the section on maceration the difficulty in arriving at a diagnosis of syphilis was discussed, and it was pointed out that in the absence of a positive Wassermann reaction and of the spirochæta pallida in the foetal tissues, all the other points in the case had to be carefully considered, such as obstetrical history, presence of chondro-epiphysitis, etc. Chief among these was the histological examination of the placenta where the size and avascularity of the villi, and the diminished extent of the intervillous spaces, helped considerably in the diagnosis.

In the same way, in the fresh foetuses, a similar difficulty is often experienced, the Wassermann reaction in the mother, and the examination of the foetal organs for spirochætes frequently giving negative results even in undoubtedly syphilitic cases. In a small proportion of cases (5 out of 20 in my series) the enlargement of the spleen makes the diagnosis practically certain, and in a much smaller percentage still (1 out of 20) the presence of chondro-epiphysitis will be equally definite. Such minor signs, as hard œdema of the body and limbs, massive hæmorrhages into organs, probably due to the action of a capillary toxin, excess of fluid in the lateral ventricles of the brain, especially when they are combined with marasmus and jaundice, will excite suspicion, but at best their evidence is only confirmatory. The lungs, liver, and thyroid show, as a rule, no abnormal naked eye appearances. The lung, to naked eye examination, may appear crepitant, non-œdematous, or only slightly so, it

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may float buoyantly in water, and yet, on microscopic examination, may present all the characteristic appearances previously described in connection with interstitial pneumonia. Neither does the liver, as a rule, show any characteristic naked eye changes, even when microscopically cirrhosis is well marked.

The Syphilitic Placenta.—Examination of the placenta is of less assistance than might be supposed. In most cases the syphilitic placenta is not in any way abnormal to naked eye examination. It is not enlarged, nor does it weigh abnormally heavy in proportion to the foetus, especially when it is kept in mind that in the premature foetus the placenta is normally heavier in proportion to the weight of the body than in the infant at full-time. In the case of the macerated foetus the placenta may or may not be enlarged; the villi are liable to be avascular on account of a cellular proliferation in their stroma obliterating the capillaries, and of an endarteritis obliterating the vessels in the larger stems. Such a condition is not confined to syphilis, but may be found in any condition where certain specific toxins circulate in the maternal and foetal blood, *e.g.* albuminuria. In syphilis, however, the cellular proliferation is usually greater in extent, so that the villi are abnormally thick; in consequence the intervillous spaces are diminished in extent and the placenta is liable to be increased in size and weight, while on account of the absence of blood vessels it is on section much paler than normal, and frequently the thickened vessels can be seen to stand out from the cut surface as white cord. The increase in size, too, expresses itself by an *increased thickness* from the maternal to the foetal surface.

These large and heavy placentas are more likely to be found in the cases where the foetus is born macerated, the reason being that the avascularity of the placenta is the cause of the death of the foetus in *utero*, and the greater the cellular proliferation in the villi the more marked will be the consequent avascularity and the more certain will be the death of the foetus in *utero*.

That this statement is only useful as a rough guide, however, is shown by the fact that of 14 macerated syphilitic foetuses in which the placenta was obtained it weighed 600 grms. and over in only two (770 and 850 grms. respectively), while of the two other definitely enlarged placentas of macerated foetuses, one from a case of diabetes weighed 630 grms. (foetus 4290), and the other from a case of albuminuria weighed 600 grms. (foetus 950). The diabetic placenta, however, though large, was not really abnormally so when compared with the weight of the foetus, and microscopically the villi were very vascular. The enlarged albuminuric placenta was much infiltrated by old blood clot, and this doubtless accounted for the increased weight.

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The placenta of the syphilitic child born at full-time, apparently healthy, is *practically normal in appearance, size, and weight*. Microscopic examination, too, usually fails to reveal any abnormality, the villi being no less vascular than normal. It is this normal amount of vascularity that has permitted the foetus to develop in *utero* to term: had it been otherwise, death in *utero* or premature death would have occurred.

In the case of the premature infant, however, microscopic examination will generally show that the villi are less vascular than normal; there are fewer capillaries present, and the villi of the arteries in the main villous stems are thicker than they should be in a healthy placenta at a corresponding period of development. It is probably this premature "ripening" of the placenta that accounts for the premature births so frequently met with in syphilis (15 cases of my series).

Thus, while the placenta may be said to be practically of no value in the diagnosis of syphilis in the full-time infant, in the premature infant, and in the macerated foetus, it may afford strong evidence in addition to that gained by examination of the foetus itself and consideration of the case history.

Histological Examination of the Foetus.—Also, as in the case of the macerated foetus, before arriving at a diagnosis of syphilis, a careful weighing of all the available evidence is necessary, so in the case of the fresh foetus, with this exception that in the latter we have available the important aid of the histological examination of the foetal organs, especially the liver, lung, spleen, thyroid, and thymus. The importance of the information thus obtained cannot be over-estimated, and in some cases will be the only evidence obtainable.

Summary.—1. Out of 200 cases of still-birth and neonatal death syphilis was the cause of death in 35, or 17.5 per cent.

2. In the presence of a history of repeated abortions, still-births or neonatal deaths, a diagnosis of maternal syphilis should be made, and treatment instituted even though the Wassermann reaction is repeatedly negative, provided other obvious and easily ascertained causes can be excluded, such as chronic Bright's disease.

3. A positive Wassermann reaction in these cases is very significant, but a negative reaction has little value, especially in cases of old-standing infection.

4. None of the cases had undergone adequate treatment during pregnancy.

5. There are few reliable signs of syphilis present on naked eye post-mortem examination. They are more likely to be present in a full-time foetus than a premature one, and most syphilitic infants are premature. Naked eye lung changes were only present in one case. The liver usually presents no abnormal naked eye appearance, except

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that it may be pale and somewhat fatty, especially where marasmus had preceded death. Histologically, 4 types were distinguished.

6. Changes were found in 4 cases, in the thyroid, of the nature of fibrosis and proliferation of the cells lining the acini, and absence of colloid.

7. *Syphilis*.—Histological changes in the thymus were found in several cases. There was marked fibrosis and few lymphocytes, but numerous plasma cells were present. The cells of the reticulum were often increased in amount; the corpuscles of Hassal seemed more numerous than normal and the individual corpuscles larger, while the central laminated body had undergone degeneration and been replaced by granular debris.

8. *Enlargement of the Spleen*, practically diagnostic when present, was only found in 5 cases of my series, the largest weighing 55 grms., namely, about six times the normal weight. In all cases the enlargement was associated with periportal cirrhosis of the liver. Histologically, it is of the nature of a hyperplasia with dilatation of the blood sinuses in the pulp. Increase in plasma cells and reticulum is not definite or constant.

9. *Chondro-Epiphyssitis* was very rarely found; it was definitely present in only one of my series, and so indefinite in two others as to be useless in post-mortem diagnosis.

10. The *Spirochaeta Pallida* was found in 8 cases of 14 known syphilitic macerated foetuses, while of the 21 fresh foetuses it was only found in one. One of those fresh foetuses in which it was *not* found was the twin of a macerated foetus in which numerous spirochaetes were present. This suggests that the spirochaete goes through a definite sexual cycle.

11. The placenta of the full-time fresh syphilitic foetus is in most cases little changed on naked eye examination. It is not increased in weight, does not appear unusually large or thick, and presents, as a rule, no characteristic appearance, and even when examined microscopically may seem perfectly normal. That of the syphilitic macerated foetus is, however, in some cases enlarged and heavy, pale on section, and on microscopic examination the villi are enlarged, fibrous, and avascular, and the intervillous spaces diminished in extent. This applies in a lesser degree to the placenta of the premature syphilitic foetus.

12. In most cases histological examination of the foetal organs, especially the thyroid, thymus, lung and liver is necessary before deciding that a case is, or is not, syphilitic. In the absence of a positive Wassermann reaction in the mother, and in the presence of a suspicious obstetrical history, histological examination will generally afford conclusive evidence.

(To be continued.)

DESCRIPTION OF AN ORGANISM OBTAINED FROM CARCINOMATOUS GROWTHS.*

By JAMES YOUNG, D.S.O., M.D., F.R.C.S.

THE organism with which this report is concerned was isolated from about forty cases of human carcinoma and two cases of breast carcinoma in the mouse.

The investigation began in an attempt from a general survey of the literature on cancer to find any facts or suggestions pointing along one common direction. One soon was struck by the fact that the body of recent opinion seemed to be opposed to the parasitic theory, but side by side with this there were many well-established facts—especially in regard to carcinoma in animals—that lent complexion to the infection theory. The remarkable investigations of Fibiger of Copenhagen were full of positive suggestion along these lines. This observer produces cancer with a striking incidence of success by feeding rats with cockroaches infected with a special nematode, and he finds the nematode in the cancerous growth of the infected rat. The tumour, it is true, he believes to be caused by a chemical irritation induced by the worm. Side by side with Fibiger's investigations, there stand recorded instances of carcinoma in association with other classes of helminthida.

It occurred to me—as it must have occurred to many others—that the animal parasite might be acting as a sort of intermediate host for some specific germ, which is liberated in its body in the infective stage, and thence is brought into immediate contact with the epithelial cells of the rat. It is well known throughout parasitology that many of the infective agents can infect only during a certain stage in their cycle, and this stage is often only reached in the body of an outside host, *e.g.*, malaria. There are other parasites which are liberated from their spores in the intestinal tract of the animal they infect, *e.g.*, the coccidium, in which the spore-case is dissolved in the rabbit's intestine, and the amœboid coccidium is set free to enter the cells of the intestinal walls. Whilst this is the ordinary sequence, germination of the spores of the coccidium can occur outside the body of the rabbit in a suitable medium and thence, by being swallowed, reach the rabbit host.

It seemed that, if there was anything comparable to these

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processes in cancer, the germination—*i.e.*, the liberation of the germ in its infective phase—must be a comparatively simple process. Whilst the spore might find a suitable medium in the intestine of the nematode, this specific medium was not necessary and might ordinarily be absent.

From a study of tumours in plants one was able to gather facts that seemed to lend support to the impression that was forming in one's mind. Many of the tumours in the plant kingdom closely resemble malignant growths in the animal; and an immediate advantage presented by a study of the vegetable growths is that the intracellular organism responsible for the disease is often definitely known. I recall one fact, derived from a study of warty disease in potatoes, which seemed strongly to bear in the direction of one's thought. It is well established that in an open field infection rapidly spreads from diseased to healthy potatoes. One observer found, however, that in a series of experiments the infection was not transmitted when the healthy and the diseased potatoes were planted together in pots. The inference seemed to me to be that in this disease an insect or worm, present in the field and absent from the pot, is ordinarily concerned in the transmission.

These preliminary investigations suggested the hopefulness of attempting germination by the use of different media reproducing as far as possible the actions of the different juices of the intestinal canal, and so discovering a medium which would imitate the process as it occurs in nature.

Source of Material.—The human material was obtained from two sources, operative and post-mortem. The former consisted of breast carcinoma (16 cases); glands, secondary to breast carcinoma (2 cases); uterine cancer (4 cases); secondary nodules in omentum or peritoneum of abdominal wall (3 cases); vulva (1 case). In some of these cases the material was brought to the laboratory under sterile conditions, and the cultures were commenced within an hour or two of the operation. The post-mortem material consisted of liver (5 cases); kidney (1 case); stomach (1 case); bowel (1 case); lung (1 case); and omentum (2 cases).

The mouse carcinoma (adeno-carcinoma of breast) was derived from a mouse obtained through the kindness of Dr J. A. Murray, Director of the Imperial Cancer Research Fund, London. This provided the first case. The second case consisted of a growth obtained in a second mouse by transplantation of a piece of the original tumour.

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Preparation of Material.—A small block is seared out of the original specimen and is placed in methylated spirit, which is set alight. The block is then cut into small fragments in a sterile Petri dish with sterile scissors.

In the case of the mouse, the animal is killed by the crushing of the neck. The whole animal is placed in 5 per cent. formalin for a few minutes, and is then washed thoroughly in sterile water, after which the tumour is excised.

Nature of Medium.—During the investigations various media have been used, such as human ascitic fluid, hydrocele fluid, and horse serum. The medium is put up in test-tubes and used somewhat after the fashion of that advocated by Noguchi for the growth of the spirochæta pallida, though a piece of animal tissue, as was found necessary in Noguchi's investigations, is not required. Neither is it necessary to cover the medium with a layer of paraffin oil.

In some of my media the essential fluid was combined with distilled water, in others with agar. During certain stages of its cycle the organism is best studied in a deep medium. In other stages the growth occurs on a surface medium in free aerobic conditions, and for this a slope medium of horse-serum-agar has been found best.

In using the deep method the piece of tumour is pushed well into the medium, and it is then surrounded by a layer of acid in solution. For this purpose I have latterly used a .2 per cent. solution of HCl in sterile distilled water. A high acidity is necessary for free growth in some of the stages. The acid is introduced by a Pasteur pipette, which is employed at the same time for the introduction of the tumour into the medium.

The recognised association of carcinoma with the helminthida led, as I have said, to an attempt to germinate the hypothetical cancer organism in a medium which would simulate the action of the intestinal juice. It was by testing this conception in various ways that a medium of strong acidity was eventually arrived at.

The earlier cultures were carried out at a temperature of 37°. Later it was discovered that the organism grows well, and, in certain of its stages, better, at the room temperature.

Controls.—During the earlier experiments rigorous controls were carried out, consisting of tubes of medium without the tumour but with the addition of the acid. In addition, pieces of tissues known to be non-carcinomatous—e.g., ovary, Fallopian tube, uterus, inflamed tonsils, thyroid, etc.—were placed in the acid medium prepared and incubated as for the cancer tissue. The controls were uniformly negative, though in two cases fungi of various unrecognised character were found growing. In the later experiments, when the specific

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character of the organism obtained from the cancerous tissue had become apparent, the controls were limited to such as were necessary to test the medium.

Stains.—The organism stains with the ordinary staining reagents—*e.g.*, methylene blue, hæmatoxylin, Giemsa, and Leishman. For ordinary routine purposes Leishman is best. It is positive with Gram's stain.

Morphological Characters.—Free growth usually occurs within forty-eight hours, showing in an agar medium as a flat, thin sheet surrounding the tumour, and crossing the medium as a transparent membrane. In the turbid horse serum and water, or ascitic fluid and water medium, the growth may be invisible to the naked eye or show only as a white or brownish area surrounding the tumour fragment, and increasing in size with the duration of the growth.

Microscopically, at this stage, the organism consists of rounded or oval bodies measuring from 0.2μ to 1μ . The individual organisms often stain at one pole, the remainder being pale. The appearance then somewhat suggests that of a signet ring (Figs. 1 and 12). At other times the bodies are oval, when the staining substance is often bipolar in distribution (Figs. 4 and 12). At still other times the rods are darkly staining throughout. The length and thickness of the rods vary greatly. Sometimes they grow in chains; in other cases the appearance is rather that of mycelial threads. The cultural characters are largely dependent on the acidity of the medium; the mycelial forms are rare in a highly acid medium.

If subcultured aerobically in this phase on a slope medium, the organism grows freely at room temperature as a raised, whitish, and slimy surface. Microscopically it shows as straight, rod-like forms, measuring 0.2μ to 0.5μ in breadth and 0.5μ to 2μ in length. Throughout such a surface growth, longer forms are usually present; they are often bent and convoluted, and they taper at their ends in an eel-like fashion. Not infrequently they stretch completely across the field (Fig. 3).

After four to six days in a deep medium, with the comparatively small, coccoid forms there are found comparatively large, round, or oval yeast-like bodies, measuring about 2μ to 3μ in diameter. In these, to begin with, the bipolar staining may be recognised; eventually, however, they are uniformly dark-staining throughout (Figs. 2, 4, 5).

In the yeast-like phase, as in the rod phase, proliferation

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is marked. A characteristic of this phase is a tendency to clumping or fusion with the formation of deeply staining masses of varying sizes, and of a rounded or irregular contour (Figs. 4, 6, 7, 8).

In an ordinary growth, after about three or four days there is often an extreme confusion of coccoid, bacillary, and large-forms.

On a slope horse-serum-agar medium the yeast-like form grows freely at room temperature as a white or yellow mould-like surface, which becomes wrinkled in the older growths. In the younger growths, the rounded bodies are discrete; in older cultures they tend to clump into darkly staining masses of greatly varying size and contour, when growth seems to become arrested. Some clumps are small, others are of very considerable size. In such masses the individual bodies are obscured (Figs. 7, 10). Except in the older cultures, rod-like forms are usually scattered about amongst the rounded bodies. In addition, there are often seen round, pale structures like ghosts of the darker forms. The significance of these pale forms will emerge later.

The appearances in culture suggest that the coccoid, bacillary, and mycelial forms correspond approximately to the same phase in the cycle of the organism, and that the yeast-like forms are a later phase in this cycle. A rather remarkable feature of the organism is the faculty of independent and free proliferation apparently possessed by these two different phases. In either case the growth may continue for several days or even weeks. Sooner or later, however, on the ordinary slope medium as in the deep medium, the smaller forms tend to become replaced by those possessing yeast-like characters.

It will be evident from the above description that we are dealing with some form of fungus, and the characters given correspond in a general way with quite a number of different fungus groups.

At first sight the inference would seem to be strong that we are concerned merely with a contamination. Even a cursory glance through the literature on cancer proves that fungous forms have often been described in association with carcinoma, only to be discarded later as contaminations. During this investigation this possibility was constantly borne in mind; but, despite more and more rigorous technique, the same forms always appeared in the cultures, alike in those where preliminary contamination was likely (post-mortem specimens), and

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in those in which the mode in which the specimens were obtained might justifiably have been expected to exclude contamination.

The fact which for long seemed to be most eloquent in favour of contamination was that we obviously were dealing in culture with forms which are absent in the ordinary histological picture of carcinoma. We shall later have some reason to qualify this statement, but it is in general terms indisputable.

A searching investigation was now commenced with a view to elucidating the life cycle of the organism. Up to this point it seemed to be clear that the smaller forms developed into the larger yeast-like bodies. There was therefore clearly a cycle, part of which was apparent. The remaining arc of the cycle—*i.e.*, the stages between the large round and the coccoid forms—was the next subject for investigation.

The first part of the enquiry had been comparatively straightforward. The next stage was to the last degree confusing, because in an ordinary culture the mingling of forms is such as to defy any effort at systematisation.

It was the discovery of the possibility of obtaining the yeast-like form in pure culture that gave new impetus to the research. The next step obviously must consist in an effort to push by a further step the development of the darkly staining clumps which formed the older stages of the yeast-like phase, and which seemed to be formed by a sort of fusion of the individual organisms. The morphological features suggested that this was a resting, possibly a sporing stage. Some of the mould-like growth was scraped from the surface of the slope medium and immersed in a fluid acid medium, and the subsequent development was followed at successive intervals. In several cases the "sporing" material used for this purpose was as old as four months.

The first change in the "spore-mass" consists in a swelling of its substance. It becomes pale, the dark area resolving gradually, and often irregularly; so that in the intermediate stages the mass is irregularly granular (Fig. 7). Eventually it becomes pale throughout, and in this phase it is almost invisible (Fig. 10). This earlier stage of germination requires about sixteen to twenty-four hours. In the next phase the mass is occupied by a large number of minute granules of varying size. The most minute granules are just visible at 1400 magnification. The granules are arranged, singly, in pairs, or in small groups (Figs. 7, 10).

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On the slope cultures one can occasionally see germination occurring, and then the granules are found lying at the surface of the adjacent round pale bodies that form the early stage in the germination of the yeast-like forms; the general appearance then produced is that of a honeycomb (Fig. 8).

This granular stage is fleeting, lasting only from a few up to twenty-four hours. It is difficult to give the exact duration of any stage, because, even with the cleanest, least confused picture of germination, the forms are never exactly in one phase at the same time. Even at this stage it is often possible to recognise all gradations between the most minute granules, up to those that have distinct characters.

The next stage consists of the enlargement of the granules into the coccoid and bacillary forms, and, during the transition, all stages in the graduated development can be traced. By forty-eight hours the coccoid and bacillary and mycelial forms usually dominate the picture. At a still later stage, the cycle is completed by the formation of the "spores" and "spore-balls." In some of the cultures the bacillary and mycelial forms are absent; and the "spore" stage arises directly from the coccoid.

I have traced the complete cycle in a considerable number of human cultures, and in the cultures obtained from both specimens of mouse cancer.

The picture just given is sufficiently clear and convincing. There are, however, particularly in the earlier process of germination, appearances which are somewhat perplexing and of which, despite careful and sometimes tedious observation, I am still uncertain. For example, one can often see in the pale round body which initiates germination a central darkly staining point, at other times what looks like a transverse bar or rod (Figs. 9, 12). At other times the germinating organisms (and the same applies to the "spore-mass") exhibit refractile granules in their substance. Occasionally the whole spore-mass is glistening and crystalline. All these changes I have seen so often that I believe they probably correspond to fleeting phases of germination. Whether or not there is anything in the nature of sexual conjugation I am uncertain. The organism possesses a remarkable polymorphism, and in this feature it resembles other types of fungi. The polymorphism is especially evident in the fluid media, and is most marked in regard to the length and thickness of the bacillary and mycelial forms.

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Study of the Tumour Fragment.—This formed an accompaniment of the study of the organism in culture ; by its means one thought it might be possible to obtain a knowledge of the source of the developing germ. After a short period of immersion the tumour substance, in the majority of cases, softens, and fragments sufficient for examination on a smear can be obtained with a Pasteur pipette. This was the routine method employed. At other times the tumour fragment was removed and fixed in Schaudinn's fixative, subsequently being cut in paraffin. This is the more satisfactory method.

The minute details of structure are in most cases quickly obscured ; and it is only on rare occasions that the sections are sufficiently free of debris to allow of any deductions. The outstanding feature is the rich development throughout the fragment of the organism just described. The growth is for the most part patchy, being most marked on the surface, where the tumour is in contact with the medium. In the deeper levels it consists mainly of small discrete aggregations of growth (Fig. 11). The stage of development corresponds with the interval during which the tumour has been immersed. In the earlier stages the picture may be a clean one of one phase ; in the later stages the coccoid, bacillary, mycelial, and sporing forms are often mingled in confusion.

At the moment of publication the findings suggest that the organism in the cancerous tissue is present in at least two forms, and that from each of these forms the cultural growth ordinarily springs—(1) in the nucleus in the minute phases, (2) in the form of individual "spores" or "spore-masses" in the nucleus or tissue spaces.

(1) *In the Nucleus.*—In the nucleus of the actively growing cancer cell there is no definable organism, and the same applies to the cancerous tissue of the early cultural experiments. But, at the end of several days' growth, where the nuclei have escaped disintegration, I have on several occasions found them apparently occupied by the coccoid and bacillary forms ; in some of my specimens this demonstration is extremely suggestive. The bodies are found lying in the nuclei, from which they are seen escaping into the surrounding area (Fig. 12). In most cases this appearance is not found, for complete disintegration of the nuclei is usually an early phenomenon.

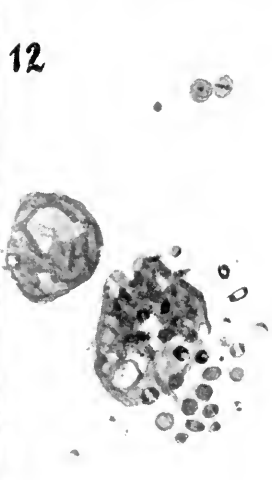
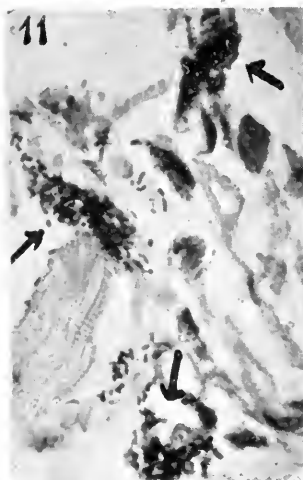
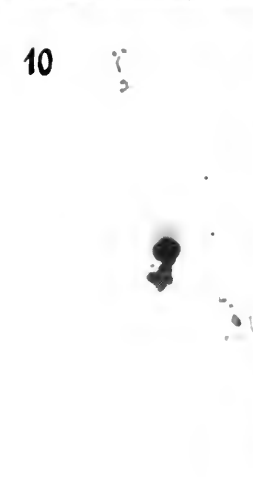
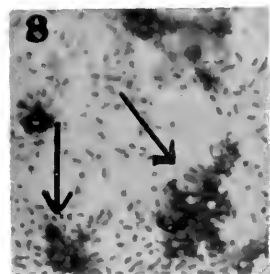
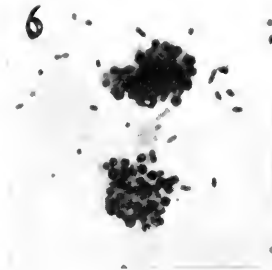
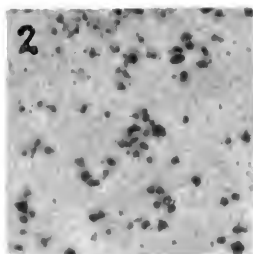
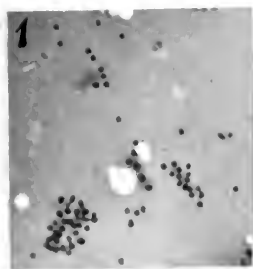
(2) *Spore Forms.*—In some specimens of carcinoma, darkly staining masses of varying size in the nuclei or in the intercellular

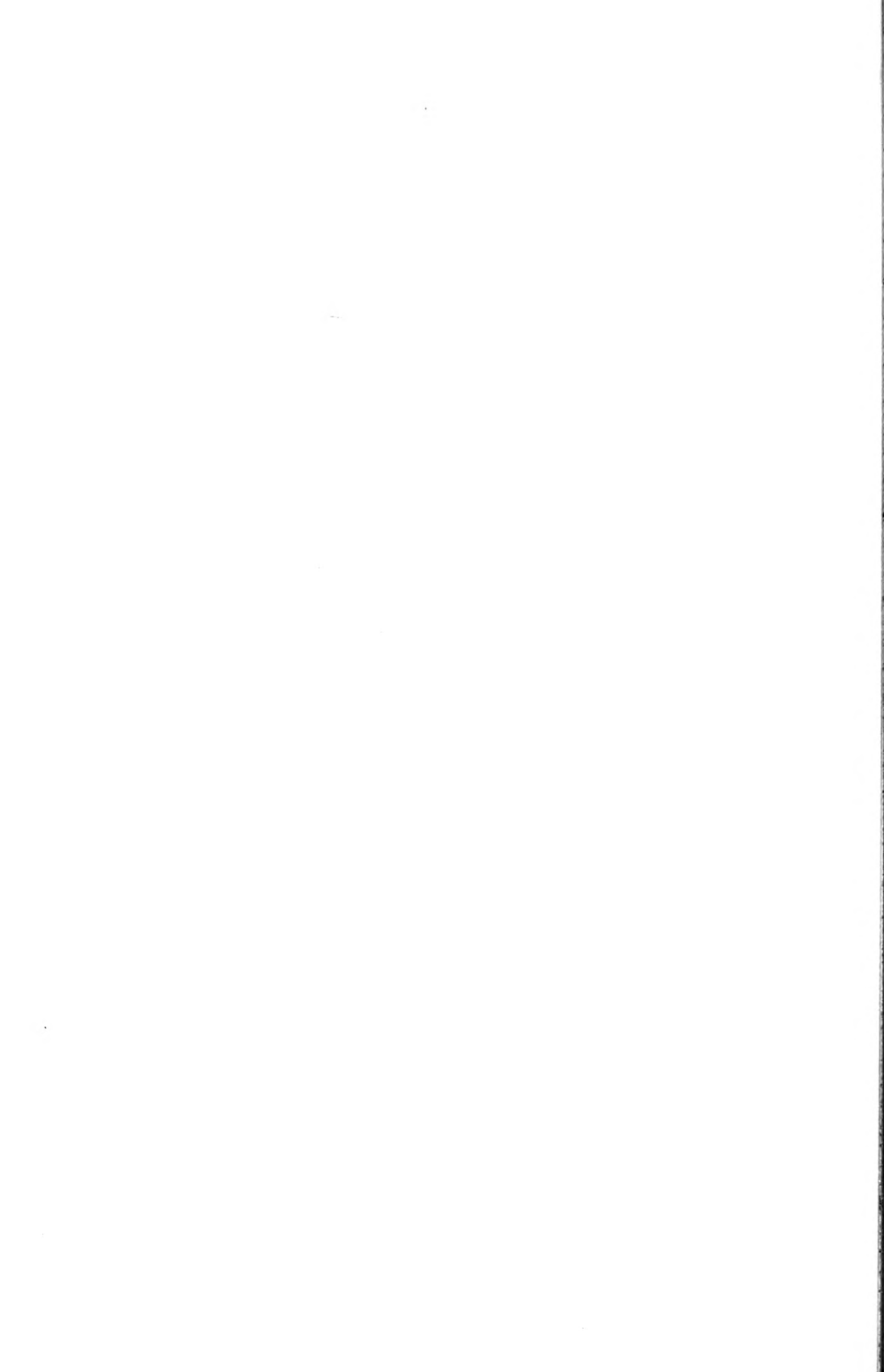
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spaces are found as a characteristic feature. The histological features of these masses often very closely resemble the "spore-balls" which I have obtained in culture, and from which the granular and bacillary phases originate. In the specimens of mouse carcinoma which I have employed, these pigmented masses occur scattered freely through the degenerating areas of the growths, and during artificial cultivation one can see them split up into finely granular masses and bacillary forms (Fig. 11), producing appearances exactly similar to those found during the artificial germination of the "spore" masses. In the mouse carcinoma this demonstration is, I believe, complete.

Experimental Investigations.—Attempts have been made to reproduce carcinoma in mice by the injection of the cultures obtained both from the human and the mouse growths. In the case of the human cultures the attempts were unsuccessful. In three mice, out of thirty inoculated with the mouse cultures, growths presenting suggestive microscopic features have been obtained, and from two of these the organism has been recovered. The sites of the tumours were: neck (axilla the site of injection), liver (intraperitoneal injection), pelvis (intraperitoneal injection). In the first case a first generation subculture was used; in the other two, cultures obtained by germinating "sporeballs" two months old were used. In no case were neoplasms found in control mice that died. Attempts to establish the malignancy by transplantation experiments were not made, and, whilst suggestive, the series is insufficient to establish any certainty in regard to the etiological significance of the organism. The investigations are being pursued in a more extensive series of cases.

Summary.—From a considerable number of cases of carcinomatous tumours an organism with a specific life cycle has been isolated. The youngest stage is minute, being just recognisable under the highest power of the microscope. This phase is derived from a germination of "spore" forms and it grows best in a highly acid fluid medium. It would represent the stage during which the original infection occurs. This stage has not been cultivated separately, because it quickly passes into a somewhat larger phase (coccoid or bacillary), which grows well at ordinary temperatures when transferred to a plate medium. This phase passes into a comparatively large sporing phase, in which it may remain dormant for long periods. The investigations open up the possibility that the smaller phases may





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ordinarily be passed in the nucleus of the cancer cell. If this is so it becomes likely that the proliferation of the cells is due to the stimulus of the intranuclear parasite, and the continued and uncontrolled proliferation that characterises a malignant growth would thus be explained by the fact that the daughter nuclei carry with them one or more germs in the dividing or vegetative phase. Finally, a record of three malignant growths apparently produced in healthy mice by the injection of the cultures tends to support the belief that the organism may possess some etiological relation to tumour growth.

The investigation was conducted in the Royal College of Physicians Laboratory, Edinburgh. I take this opportunity of thanking all my friends (too numerous to mention individually) who helped me with material. I am indebted to the National Research Council for a grant in aid of the research.

The microphotographs were taken by Mr Richard Muir. The drawing was made by Mr J. Grieve.

DESCRIPTION OF FIGURES.

- FIG. 1.—Coccoid forms. Forty-eight hours culture of human carcinoma in acid fluid medium. × 1500
- FIG. 2.—Yeast-like bodies developing from coccoid forms. Four days culture of human carcinoma, later stage of that shown in Fig. 1. × 1500
- FIG. 3.—Bacillary and mycelial forms. Subculture on plate medium of three days old culture of mouse carcinoma in acid fluid medium. × 1000
- FIG. 4.—Chains of "sporing" forms. The arrow points to a clump of larger forms. This chain arrangement is rare. Subculture (forty-eight hours old) of ten days old culture from human carcinoma. × 1000
- FIG. 5.—Yeast-like, bacillary, and coccoid forms, mouse carcinoma. × 1000
- FIG. 6.—Two "sporeballs" in early stage of germination. Slope culture of human carcinoma forty days old, subcultured (twenty-four hours) in acid fluid medium. × 1000
- FIG. 7.—"Sporeballs" becoming irregularly granular and forming coccoid and bacillary forms. Culture same as in Fig. 6. × 1000
- FIG. 8.—"Sporeballs" germinating. The arrows point to honeycomb-like masses which are splitting into coccoid and bacillary forms. Direct slope culture (acid medium) from mouse carcinoma three days old. × 1500
- FIG. 9.—Nucleated pale bodies formed during germination of yeast-like bodies. Human carcinoma. × 1500
- FIG. 10.—"Sporeballs." The central one is darkly staining, the one above and the other to right have passed into pale stage and are forming granules. Subculture (twenty-four hours) in acid fluid medium of slope culture from mouse carcinoma (thirty-six days old). × 1500
- FIG. 11.—Section of mouse carcinoma showing three dark-staining masses ("sporeballs"). The one to left and the other below are splitting into coccoid and bacillary forms. Cultured four days in acid fluid medium. × 1000
- FIG. 12.—Nucleus from human carcinoma surrounded by coccoid and "sporing" forms which seem to be escaping from it. Germinating forms above. × 1500

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pushed upwards and forwards, while the vagus group is pressed down and backwards.

Changes in Labyrinth.—Here the first stage appears to be fibrinous exudation in the perilymph spaces (choked labyrinth), with more or less atrophy of the cochlear ganglion cells, of Corti's organ and stria vascularis, especially in the basal coil. Later on the fibrinous exudate becomes organised into delicate myxomatous tissue. New bone formation may be seen in this. As a rule the vestibular maculae are well preserved in spite of the pressure destruction of the vestibular ganglion, but in advanced cases the cristae of the canals show atrophy.

Symptoms.—As a rule symptoms of acoustic tumour do not appear below the age of twenty—thirty to fifty years is the usual period. The clinical history may be divided into three stages:—(1) Initial or "otological," commencing with tinnitus, deafness, and giddiness, loss of balancing and nystagmus, and ending with headache which is worst at night. Vestibular disorders may precede the cochlear symptoms. In the earliest phase deafness is not complete, and the vestibular reaction may be present, though diminished. (2) Intermediate or "neurological" with headache (occipital and later frontal), tendency to fall to side of lesion, loss of tone in limbs on homolateral side with dysdiadokokinesia, involvement of neighbouring nerves producing loss of conjunctival reflex, diminution of cutaneous and buccal sensibility (5th), diplopia (6th), facial weakness or paralysis (7th). Later on there is dimness or loss of vision (choked disc), paresis of palate, dysphagia, thickness of speech, loss of taste, anosmia, tachycardia. Homolateral paresis of the tongue may be present. The so-called "cerebellar seizures," or vagal attacks, are a distressing feature. They may be preceded by giddiness, headache, dimness of vision, or congestion of the face. At first the patient is conscious during attacks but later unconscious. The pupils are dilated during attacks, with stertorous breathing and rapid irregular pulse. There are jerkings of the head and extremities, followed by general rigidity and opisthotonus. The attacks may be accompanied by vomiting and followed by sweating. Cushing attributes them to excessive tension in the lateral lymph cistern in which the tumour lies. (3) Terminal stage with disturbance of memory, loss of weight, weakness of sphincter control, periods of excitement resembling those of delirium tremens, dementia, Cheyne-Stokes respiration and coma.

Examination of the Ears.—All observers admit that the ideal we have to aim at is the recognition of the lesion at the "otological" stage. For this reason a thorough examination of the cochlear and vestibular function is essential. At first the signs of nerve

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deafness may not be absolute. Further, vestibular response may be obtained, so that diagnosis at this period appears impossible. Concentric narrowing of the range of hearing is, however, characteristic. Weber's test is lateralised to the good ear; Schwabach shortened on the affected mastoid; absolutely negative Rinne on affected side; later on, total deafness on the affected side, as tested with the noise box in the sound ear. Vestibular examination shows spontaneous rotatory nystagmus, which is usually more marked to the affected side. Spontaneous nystagmus on looking up has been frequently observed. The nystagmus may change from time to time, as in cerebellar abscess. There is also loss of vestibular response to the caloric and galvanic tests. The pointing reaction is usually normal. The rotation test is not so satisfactory as the caloric, which on the healthy side gives a normal or even an excessive reaction—"lasting nystagmus"—with the usual pointing error. On the other hand, there is no caloric reaction from the affected ear and no pointing error. The galvanic reaction is reduced or absent on the affected side.

Differential Diagnosis.—If solitary tumours of the eighth nerve are to be diagnosed at the early stage it is of the utmost importance that otologists should thoroughly examine all cases of unilateral nerve deafness. Eighth nerve neuroma must be diagnosed from:—
(1) Acquired syphilitic neurolabyrinthitis by the history and the Wassermann reaction of the blood and cerebro-spinal fluid. (2) Neuritis of the cochlear or vestibular (or both) divisions due to (a) exposure to cold wind; (b) toxæmia; (c) quinine, salicylate, arsenical poisoning. One does not find complete deafness in the above conditions. (3) Hæmorrhage into the labyrinth, by blood examination. (4) Senile or arterio-sclerotic deafness is bilateral; the vestibular reactions are retained. (5) Unilateral congenital deafness is rare; the vestibular reaction is usually present. (6) Circumscribed labyrinthitis is associated with otitis media. (7) Latent labyrinthitis can be diagnosed by the history and the galvanic test. (8) Otosclerosis by functional examination. (9) Serous meningitis in the lateral cistern (Bárány's symptom complex) is associated with a history of otitis media and a well-marked pointing error. Lumbar puncture results in improvement and a return of normal caloric reaction.

Cushing gives the following list of errors in diagnosis: (a) The symptoms of tumour of the acoustic nerve are ascribed to another lesion—Bell's palsy, trigeminal neuralgia, multiple sclerosis, multiple neuritis of cerebral nerves, torticollis, bulbar paralysis, locomotor ataxia, tuberculous or syphilitic basal meningitis. (b) A tumour is diagnosed but incorrectly localised—e.g., tumours of the corpora

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quadrigemina, of the third ventricle, of the temporal lobe, of the cortical facial area, or of the frontal lobe. Pontine tumours are characterised by paralysis of the eye muscles (Hezel). (c) A tumour is correctly localised in the cerebello-pontine angle, but the relation of the growth to the eighth nerve is not appreciated. There may be difficulty in diagnosing the side of the tumour. The best method is to judge by the deafness and the results of vestibular examination. Oppenheim states that ocular paresis, unilateral loss of the corneal reflex and of the function of one-eighth nerve make up the characteristic triad of symptoms of tumour of the acoustic nerve. Henschen points out that the portion of the tumour in the internal meatus dilates the meatus, and that this can be seen in a good radiogram.

Prognosis.—Toynbee and Henschen have recorded cases with deafness sixteen to twenty years before death. Henschen gives the average duration of illness as three and a half years. Cases in young subjects are more rapid in their progress. Only solitary unilateral tumours are suitable for operation. Bilateral cases are associated with general neurofibromatosis.

Treatment.—There are two routes by which the tumour may be reached:—(1) Occipital—either (a) unilateral (Krause), or (b) bilateral (Cushing); (2) translabyrinthine (Panse and Quix). These two routes may be combined. The mortality by the Krause method was 80 per cent. Cushing's operative mortality was only 20 per cent. and has recently been reduced to 15 per cent. Cushing, however, only claims to perform an extensive decompression operation, combined with removal of "as much as possible" of the growth. The tumour originates in the internal auditory meatus and only later extends to the posterior fossa. Cushing's route is designed for removal of the intracranial extension of the growth rather than for extirpation of its origin within the internal auditory meatus. In 1904 Panse proposed that tumours of the acoustic nerve should be removed through the middle and inner ear, and in 1911 Quix of Utrecht was the first to operate by this route. The only objection—a serious one—is the injury to the facial nerve. First of all, it is necessary to perform a free radical mastoid operation, and thereafter to obtain space reaching in front to the carotid canal, below to the jugular bulb, behind to the sigmoid sinus, and above to the dura of the temporo-sphenoidal lobe. The danger of injuring the carotid is small. The inferior petrosal sinus and jugular bulb are much more likely to be injured and to give rise to troublesome hæmorrhage. After removal of the petrous pyramid, one raises the temporo-sphenoidal lobe and splits the dura beneath the superior petrosal sinus as well as that lining the internal meatus, and thus completely exposes and removes the tumour. The wound cavity is

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packed with iodoform gauze and a plastic operation is performed on the membranous meatus. Four cases have been operated on by the translabyrinthine route, and as yet there have been no deaths (Schmiegelow). If a tumour cannot be removed by the translabyrinthine it cannot be removed entire by the paracerebellar route.

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BACILLARY DYSENTERY IN CHILDREN.

By ALEXANDER GOODALL, M.D., F.R.C.P.

BEFORE the war, except for occasional outbreaks in institutions, dysentery had become a rare disease in adults.

The association of dysentery with war conditions is a remarkable one. The disease has accompanied every campaign in history, and since the discovery of the two types of the disease the incidence of both has been found to be similar. The great majority of the early cases have been of the amœbic type, but in a short time the bacillary type has become much more in evidence and apparently has spread with greater rapidity. If one may judge by personal experience the amœbic type is the last to go, since the majority of cases seen at the present time in practice are of the amœbic type.

The chief means of the spread of the disease is the activity of flies. This emerged very clearly in Salonika. The disease among the troops there reached its maximum incidence in May and September, and it was found that in these months the fly pest was at its worst. In this connection the writer was much interested to read the following paragraph in Chambers's *Domestic Annals of Scotland*:—"The summer of this year (1723) was remarked to be unusually dry and sultry, with little wind. The air seemed stagnant, and the water unwholesome. *Vast abundance of flies resulted, and a bloody flux became prevalent.* 'In one quarter of the parish (of Eastwood in Renfrewshire),' says Wodrow, 'I saw nineteen sick persons in one day (23rd August), and all of them save one of the flux. I have never seen so much sickness in Eastwood for twenty years.'" At the same time, we wonder what Wodrow would have said if he could have seen 900 sick persons in one day in the 42nd General Hospital, and all of them "sick of the flux."

Since the beginning of the century it has been known that one of the two main conditions known as summer diarrhoea of infants is due to the bacillus of dysentery, but the knowledge is probably not so general as it might be, and we confess to being mildly startled by the opening sentence of a recent paper by Davison,¹ which reads:—"Bacillary dysentery is a disease chiefly affecting babes and soldiers."

Davison has made a very careful study of 134 cases of diarrhoea occurring in Baltimore and Birmingham, Alabama. Clinically the disease is a definite type, occurring usually in well-nourished and previously healthy children, whose ages ranged from 3 months to 11 years. Breast-feeding appears to be an important factor in diminishing the incidence of the disease in the younger children. The onset was characteristic and sudden; the child lost appetite and became irritable

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and fevered; vomiting and convulsions were frequent initial symptoms. Within a few hours there was an increase in the number of stools; these were at first faecal, rarely green, becoming blood-tinged on the second day, and within four days consisted almost entirely of blood and mucus. The number of stools ranged from three to thirty a day. The size of the stool was usually small and seemingly out of all proportion to the patient's straining efforts. The fever subsided in most cases by the fifth day. The patients were usually seriously ill, crying feebly when disturbed, were drowsy and apathetic after their initial irritability had ceased and had little or no appetite. Loss of sleep due to the frequent and often painful bowel movements was a distressing factor. Dehydration and loss of weight was evident by the end of the first week. In the patients who recovered, the blood disappeared from the stools during the second week and the diarrhoea abated by the fourteenth day. This was the course in 79 per cent. of the cases, but in a small number the symptoms were atypical.

In a few cases there was no sudden onset. The child had occasional vomiting and three to six loose green stools a day. The stools frequently contained mucus. The weight was stationary or showed a slight decrease. After several weeks the stools became tinged with blood, the temperature was slightly increased, diarrhoea was a little worse and then the patient reverted to his previous condition. In three such cases Flexner's bacillus was isolated during the period when blood was passed, and in a fourth agglutinins of Shiga's bacillus were present in the serum. These cases are regarded as dysentery supervening upon a previously inflamed intestine. Such cases must be distinguished from cases of intestinal indigestion, in which the stools contain blood (usually bright red streaks) on one or two occasions and never for longer than one day. The blood in these cases is probably the result of mechanical irritation of the lower rectum due to straining.

The average leucocyte count for the cases investigated was 13,000, and the average for the fatal cases was 13,700. Wide variations were noted, and the count was found to be of little diagnostic importance. Physical findings also were of little help in diagnosis. The liver was occasionally enlarged and tender; in one case there was enlargement of the spleen, and abdominal tenderness was not much in evidence. Complications were infrequent.

The post-mortem finding in practically all the children who died of uncomplicated dysentery was an ulcerating or necrotic enterocolitis. In cases of malnutrition, rickets, scurvy, or other condition in which an added dysenteric infection had simply been the last straw, there might be no more than slight hyperæmia or slight ulceration of the follicles of the lower third of the ilium and of the colon. The autopsy appeared to reveal the severity of the infection and the virulence of

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the causative organism, and this series of cases did not confirm the common statement that the degree of ulceration of the intestine depends on the length of the illness. The examination of one case of but three days' duration showed the ulcers and membrane of typical acute dysentery.

In one series of 13 cases, dysentery bacilli were isolated in 10. In a series of 31 cases, infection with dysentery bacilli was found in 83 per cent. The ratio of Flexner to Shiga infections was 8 to 1. The dysentery agglutination reaction assists the diagnosis of dysentery. Cultures and technique should be standardised with normal control sera, especially in Flexner infections, as the agglutinability of different strains of this organism varies considerably.

Davison recommends the standard cultures issued by the Department of Pathology, University of Oxford.

In addition to the cases of clinical dysentery described, the author studied the stools of 63 cases of diarrhoea which occurred in the course of other illnesses. The onset of the increased frequency of stools in these cases was insidious; there was no irritability or increased temperature; there was sometimes vomiting, but loss of appetite was not obvious. Practically all gave a history of dietetic indiscretion, especially of high sugar feeding. The stools were always fæcal, usually green, and contained no blood. Only in cases of long duration was mucus present in excess. In none of this group except in typhoid infection was there any evidence of an acute intestinal infection. The stools of these cases and of 100 normal children served as a useful control to the cases of dysentery, for in none of these cases were dysentery bacilli recovered from the stools. The study of these cases led to the conclusion that *B. Morgan*, No. 1, *B. Welchii*, *B. pyocyaneus*, *B. proteus*, and the *Streptococcus faecalis* are not the cause of dysentery or diarrhoea.

As regards etiology of the dysentery cases, it was found in many instances that there had been contact with another child or adult suffering from a mild diarrhoea. In several instances two cases occurred in the same house. An examination of the milk supply showed that the dairy could not be the source of infection. Studies of adult dysentery have shown that large epidemics may be water-borne, but bacilli are rarely recovered from central water or milk supplies. It has been suggested that as most of the affected children are of the creeping age, infection may be acquired by the child's fingers becoming soiled on the floor. The infection of milk in the individual household by flies or the mother's fingers, is a possible explanation of the spread of dysentery. The boiling of milk and milk mixtures before feeding has an important preventive effect.

Flies, however, are the chief offenders. Dysentery bacilli which

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live with difficulty outside the human body weather the winter by means of chronic and mild cases and carriers, and in the spring are ready for wider dissemination by means of flies.

The chief preventive measures are breast-feeding or boiling of milk. Children and milk should be protected from flies. When cases occur the stools should be completely covered, so that flies do not have access. Those engaged in nursing dysentery patients should not prepare food for other children. This form of diarrhoea—dysenteric diarrhoea as it used to be called—is extremely apt to spread in the wards of children's hospitals and similar institutions, and when cases occur they should at once be isolated and the strictest precautions taken against the spread of infection. It is problematical whether inoculations with dysentery vaccines will prove of value in children.

REFERENCE.—Davison, *Johns Hopkins Hospital Bulletin*, July 1920.

LEUCOCYTHÆMIA.

By ALEXANDER GOODALL, M.D., F.R.C.P.

A REMARKABLE case of aleukæmic leukæmia with unusual skin manifestations is reported by Blankenhorn and Goldblatt.¹

The patient was a fireman, who took influenza followed by great weakness and soreness of the muscles and the appearance of peculiar red spots on his chest. Crops of these spots afterwards appeared and disappeared on various parts of his body. There was slight fever, blood cultures were negative, and there was a negative Wassermann reaction.

When admitted to hospital the entire surface of the body, including the scalp, soles, and palms, was covered with skin lesions. These were of different kinds and shape and varied in size from miliary points to patches more than 5 c.m. in diameter. The majority were purple, hæmorrhagic in appearance, slightly elevated, thick, and firm. Some showed extreme redness, others were purple, and some were brown. Some showed desquamation, others had their surface elevated by a layer of creamy pus; none were deeply ulcerated. All showed varying degrees of infiltration and hæmorrhage. The oral mucous membrane and the conjunctivæ showed the same lesions. Superficial lymph nodes were slightly enlarged. There was iritis. The spleen was easily palpable. Nodules could be felt in the epididymis. Knee and ankle jerks were absent.

Red corpuscles numbered over 6,000,000, leucocytes, 7200. A later count showed 5000 leucocytes; of these 4 per cent. were large mononuclears, 6.5 per cent. small mononuclears, 85 per cent. neutrophils, and 2.5 per cent. eosinophils. Lumbar puncture revealed a normal fluid. A mild fever persisted, and the patient became emaciated, and, at times, delirious. The red cells fell to 3,500,000. The leucocyte picture showed no essential change.

Repeated microscopic examination of the skin lesions showed infiltration of the corium with two types of cells; atypical endothelial cells and large and small lymphocytes. The infiltration was most evident in the neighbourhood of the sweat glands. It was impossible to differentiate between lymphosarcoma and leukæmia of the skin. A post-mortem examination revealed the infiltration characteristic of leukæmia. The kidneys showed the usual patchy appearance. The infiltration of the heart which is illustrated is very striking. The bone-marrow showed an increase of the cellular elements and a decrease of fat. The various cells were present in about their normal proportions.

Symmers² reports a case under the name leukanæmia, a term

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which we had hoped had been allowed to die. The condition first described by Leube under this name was simply myeloblast leukæmia with very severe anæmia of myeloblast type. The anæmia presents most of the characters of pernicious anæmia, but this is precisely what happens in all patients suffering from myeloblast leukæmia who do not die of hæmorrhage, toxæmia, and exhaustion, or some complication.

The case recorded is that of a woman, aged 32, admitted with pallor and weakness, and enlargement of the liver and spleen. Examination of the blood showed red corpuscles, 630,000; Hb. 20; leucocytes, 36,000; megaloblasts and normoblasts were numerous. Of the white cells 51 per cent. were myeloblasts. The author remarks that, histogenetically, pernicious anæmia, myelogenous leukæmia, and leukanæmia are closely related conditions and represent different quantitative responses on the part of the bone-marrow to regenerative stimuli acting on the same metrocyte, namely the myeloblast.

We are not certain that we quite follow this. We have seen numerous cases of myelocythæmia and myeloblastic leukæmia which have become so anæmic both in degree and kind as to present a red cell picture of pernicious anæmia. We have never yet seen a case of pernicious anæmia which had become anæmic.

Lambright³ discusses the diagnosis between lymphocyte and myeloblast leukæmia, and lays considerable stress on the value of the oxydase reaction as a means of determining the character of the myeloblasts. We are a little sceptical about the value of this reaction. In our experience a positive or negative oxydase reaction is largely a matter of technique, and an interesting paper by Menten which appeared some years ago showed that the reaction could be obtained in all the tissues of the body, except bone, which had not been investigated, and that the incidence of the reaction appeared to correspond closely with the distribution of potassium.

Ellermann⁴ has published observations on a new strain of leukæmia in fowls, which has been transmitted through twelve generations. An increase of virulence was noted during its passage. As with former strains the type of the disease was myeloid, but a single lymphatic case was observed.

Active immunisation could not be produced by the subcutaneous injection of virulent material. The finding that the virus is filterable has been confirmed. The inoculation of human leukæmic material into fowls gave negative results.

REFERENCES.—¹ Blankenhorn and Goldblatt, *Journ. Amer. Med. Assoc.*, 26th February 1921. ² Symmers, *Journ. Amer. Med. Assoc.*, 15th January, 26th February 1921. ³ Lambright, *Amer. Journ. of the Med. Sciences*, February 1921. ⁴ Ellermann, *Journ. of Exper. Med.*, 1st April 1921.

NEW BOOKS

Rheumatism and Arthritis. By RALPH STOCKMAN, M.D., Professor of Materia Medica and Therapeutics in the University of Glasgow. Pp. 132, with 110 illustrations. Edinburgh: W. Green & Son, Ltd. 1920. Price 15s.

Professor Stockman's monograph on rheumatism and arthritis must necessarily make a strong appeal to a wide circle of readers, embodying as it does a mass of personal observation and investigation, and expressing the considered opinions of one who is a recognised authority on these diseases, which are of everyday occurrence and bulk so largely in practice. The terms "rheumatism" in particular, and "arthritis" in a lesser degree have too long served as convenient cloaks for ignorance, and any endeavour to clarify the various conditions commonly included under these labels, and to set them on a satisfactory and scientific basis, is a real service to Medicine, and we think that Professor Stockman has handled this admittedly difficult subject with notable success.

The thesis, elaborated especially by Rosenow in recent years, that different strains of one particular organism possess an elective affinity for different tissues of the body, is extremely attractive in relation to a disease of such protean manifestations as "rheumatism," and we are glad to see it enunciated by the author in discussing acute rheumatism. His second class of acute rheumatism might well be regarded as a sub-acute type linking up the classical acute articular rheumatism with chronic articular and muscular rheumatism and fibrositis.

Under the unfamiliar heading "panniculitis" much new ground is broken, and this chapter is one of the most interesting and instructive in the book. It is open to question, however, whether it is desirable to add to the nomenclature of rheumatic conditions by introducing another term such as panniculitis, which merely serves to give the disease an anatomical site, without any etiological qualification.

Professor Stockman's treatment of the great and much debated class of the chronic non-suppurative arthritides naturally arouses greatest interest, and we can commend his subdivision of these cases into (1) rheumatoid arthritis, and (2) chronic infectious arthritis, but agree that the latter term is merely provisional and will require qualification in the light of further knowledge. The pathology of rheumatoid arthritis is fully discussed, but little additional light is thrown on its causation, and it is summed up as being stamped by its morbid anatomy and clinical course as a chronic germ disease.

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Osteo-arthritis is very thoroughly described and is differentiated clearly from rheumatoid arthritis.

Certain minor criticisms arise, and we think that the author has done scant justice to the possibilities of surgery in the treatment of Dupuytren's contraction, nor are we willing to concede that abdominal panniculitis often leads to a mistaken diagnosis of appendicitis and renal or hepatic colic.

Two features of the book call for special commendation—the wealth of historical references and the excellence of the numerous plates illustrating the pathology of the various conditions discussed in the text. These greatly enhance the educational value of a book which should be widely read.

Cesarean Section, by FRANKLIN S. NEWELL, M.D., Professor of Clinical Obstetrics, Harvard University; *Extra-Uterine Pregnancy*, by EDWARD A. SCHUMANN, M.D., Lecturer on Obstetrics, Jefferson Medical College, Philadelphia; *Pelvic Inflammations in Women*, by JOHN OSBORN POLAK, M.D., Professor of Obstetrics and Gynecology, Long Island Hospital College; *Gynecological and Obstetrical Tuberculosis*, by CHARLES C. NORRIS, M.D., Associate in Gynecology, University of Pennsylvania, School of Medicine; *Menstruation and its Disorders*, by EMIL NOVAK, M.D., Instructor in Clinical Gynecology, Johns Hopkins University, *Gynecological and Obstetrical Monographs*. D. Appleton and Company, New York and London, 1921.

These five volumes are part of a series of gynecological and obstetrical monographs published by the well-known firm of Appleton. They are not designed to be exhaustive treatises on the subjects with which they deal, so much as to be practical and full discussions on the subjects for the use of the general practitioner. It may be said at once that the authors appear to have kept this laudable aim clearly in view. The various volumes are full, but not overloaded with material suitable only for the specialist; practical but not burdened with too much technical detail; comprehensive, but in most cases just sufficiently dogmatic to suit the readers for whom they are intended. The publishers are to be congratulated on their scheme and on the success which these volumes assure for it. All the volumes are clearly printed, and adequately illustrated, and they are all of a size convenient for reading and holding in the hand.

Professor Newell's book contains a careful analysis of the indications for the performance of Cesarean Section, an operation which is undoubtedly in some danger of being abused. The contra-indications accordingly also receive detailed consideration. Even enthusiasts, however, will admit that the author draws his line widely, and includes

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all justifiable indications. Particular emphasis is rightly laid on the paramount importance of careful antenatal study to determine in advance the appropriate line of treatment. He draws attention to the three factors involved in every case of labour in contracted pelvis, namely the size of the pelvis, the size of the foetal head, and the powers of the uterus. He sees no great scope for the extra-peritoneal method of operation. It is to be observed that he uses the term "Porro" operation for Cesarean Section followed by hysterectomy, while he objects to the use of "vaginal Cesarean Section" instead of vaginal hysterotomy. This seems inconsistent, and we would prefer to see both operations described by truly technical terms, namely Cesarean hysterectomy, and vaginal hysterotomy.

Dr Schumann's able essay on Extra-uterine Pregnancy deals interestingly with the history of the subject, and then discusses systematically the etiology, anatomy, pathology, course, diagnosis and treatment. By a careful analysis he places the absolute frequency of the condition at 1 to 300 ordinary pregnancies. The vexed question of the etiology is not over-elaborated, but we think he dismisses the possibility of external migration of the ovum too lightly, while there is no mention of the theory of premature development of the trophoblast, which presents the condition as a suggestive possible contrast to placenta prævia. In regard to treatment the author thinks the wisest rule is to operate on every case as soon as the conditions for proper antiseptic and aseptic surgery are obtainable. He wisely advocates the removal of the whole of the affected tube, the leaving of the opposite tube if apparently healthy, and in general the minimum interference with the pelvic and abdominal contents beyond what is essential. The illustrations are mostly good, but the value of the borrowed microscopic drawings is greatly lessened by the absence of explanatory legends. There are numerous minor errors in the use of both English and Latin words which mar an otherwise praiseworthy monograph.

Professor Polak's volume on Pelvic Inflammations is a thoroughly excellent one, not exhaustive by any means, but most illuminating and instructive. The author has a clear conception of what he wants to say and says it with that degree of dogmatism that is necessary to carry conviction. This is particularly valuable in the discussion of the treatment of puerperal infections, where the harassed practitioner will welcome a clear-cut plan of treatment based upon an extensive experience. No place is found in this scheme for either sera or vaccines, which have in our experience proved of great value in some cases. The illustrations are good and some of them original in conception. There is little need to say more about this book, except that it is emphatically a good one by an obviously practical teacher.

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Dr Norris's book on Tuberculosis seems a little out of perspective seeing that it is about the same size as the previously mentioned volume, which covers the whole field of the other vastly more frequent and more important varieties of infection. But gynecological tuberculosis has until recently been rather overlooked, and it is perhaps inevitable that it should now receive a somewhat excessive attention. The author gives a careful summary of present-day knowledge and a useful index to the literature. Not only is the whole field of gynecological tuberculosis in the strict sense covered, but in addition there are chapters on tuberculous affections of the breast and the peritoneum. The obstetrical section of the book presents a most valuable and interesting discussion of tuberculosis in relation to pregnancy, labour, and the puerperium, including that most moot point of the artificial interruption of pregnancy in tuberculous women. The writer repeatedly refers to his patients as the "incumbents of tuberculosis," which is surely an expression unjustified by either etymology or elegance, by custom or convenience.

Dr Novak's monograph on Menstruation is more of a treatise than the others. It is a unique book, dealing in a most comprehensive way with the whole subject and bringing it right up to date. All the great mass of literature of the last twenty years on this subject has been thoroughly sifted, and where possible the conclusions reached have been clearly marshalled. Where no reliable conclusions are yet possible the arguments and theories are lucidly explained and analysed. In addition to normal menstruation the book deals with the menopause, and with menstrual disorders, such as amenorrhœa, dysmenorrhœa, vicarious menstruation, etc. The mutual reactions between menstruation and various diseases are carefully discussed, as well as the bearing upon the whole subject of our knowledge of endocrinology. In no other book have the various aspects of the subject been brought together in this way. Dr Novak has produced a masterly volume, based on a very extensive study of the literature, and he has put the profession under a considerable debt of gratitude.

Gynæcology. By BROOKE M. ANSPACH, M.D. Pp. xxvi. + 752, with 526 illustrations. London: J. B. Lippincott Company. 1921. Price 42s. net.

This text-book, written by one of the Pennsylvania school, is dedicated to and to a certain extent inspired by Dr J. E. Clark of that city. It is, if anything, to the advanced side for the medical student, but for the practitioner or the student for more advanced degrees, it is a most valuable work of reference and study. The subject is taken up on a systematic plan, starting with the development, anatomy, and physiology of the reproductive organs, and works through the causes,

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symptoms, diagnosis, and treatment of the diseases of the various organs, with special chapters devoted to group symptoms and special treatment.

Dr Anspach includes in his volume such allied conditions as diseases of the bowel and urinary apparatus as are frequently met with by the gynæcologist, and a lucid and valuable chapter is on the examination of the urinary organs, detailing the latest methods of diagnosis. Similarly, a chapter is devoted to post-operative complications, mechanical aids to treatment, radium and Röntgen ray and vaccine therapy, which make this volume a most complete book on the subject of gynæcology. The illustrations are helpful to the text, except in such an obvious transposition of Fig. 36 for Fig. 35. The bibliography at the end of each chapter is carefully selected, and the references in the text bear the imprint of a writer who is weighing authoritative views of others with his own personal experience, and giving the reader the full value of both. The practical knowledge of the author is obvious throughout, and he is to be congratulated on writing a text-book which deserves popularity in this country equal to what it will undoubtedly obtain in America.

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Encyclopædia Medica. Edited by J. W. BALLANTYNE, M.D. Second Edition. Volume VII. Pp. viii. + 611. Edinburgh: W. Green & Son, Ltd. 1921. (Price not stated.)

The rubrics in this volume of the *Encyclopædia Medica* run from "Intestines" to "Labour," whence it is to be presumed that Dr Ballantyne has now accomplished one half of his arduous task—a task for which he has shown himself so pre-eminently fitted. The articles in the new volume have all been revised, and it is gratifying to note that in most cases the revision has been carried out by the original authors. Nearly half of the volume is devoted to "Labour," and we welcome the new articles on various aspects of this important subject which have been contributed by the editor. They are thoroughly good practical guides, and greatly enhance the value of the *Encyclopædia*.

Physiology and Biochemistry in Modern Medicine. By J. R. MACLEOD M.B. Third Edition. Pp. xxxii. + 991. London: Henry Kimpton. 1920. Price 42s. net.

The appearance of a book of this kind is one of the most hopeful signs of the progress of clinical medicine. For two reasons: first,

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because those who, like the reviewer, learned their physiology and physiological chemistry in the end of last century, studied a subject which, as it was then taught, was divorced—almost openly divorced—from all relationship with practical medicine. The newer school of physiologists and biochemists have changed all this, and have come to regard the living man as the best of all laboratory animals, whence arises the second reason for welcoming this book, for the strides of physiology and chemistry have been so great that without some such guide the newer knowledge cannot be placed within the reach of the average clinician. Professor Macleod has found it necessary, in view of the scope of the book, to call in assistance in the writing of many of the chapters, and the reviewer has neither the technical knowledge, nor the desire, to attempt any form of detailed criticism. No doubt, in so enormous a mass of material, there must be errors in presentation and interpretation and the like, but the main current of knowledge flows steadily in the right direction. The book is divided into nine parts, dealing with the chemical basis of physiological processes, the circulating fluids, the circulation of the blood, the respiration, digestion, the urine, metabolism, the endocrine system, and the nervous system respectively. Since it came into his possession, the volume has constantly been laid under contribution by the reviewer, in connection with the study of all kinds of medical cases, and has proved an illuminating and instructive guide. It is an adjunct to systematic and clinical treatises which no physician would willingly dispense with, and is certainly one of the most noteworthy of recent additions to medical literature.

Skin Diseases in General Practice: Their Recognition and Treatment.

By HALDIN DAVIS, M.B., B.Ch., B.A. (Oxon.), F.R.C.S. (Eng.), M.R.C.P. Second Edition. Pp. xii. + 355, with 81 illustrations. London: Henry Frowde and Hodder & Stoughton. 1921. Price 25s. net.

It is a great satisfaction to the practitioner to be able to diagnose with confidence a skin condition, and more especially to effect a cure. A second edition of this already well-known volume of Dr Davis should be welcomed. The book has been slightly extended, in addition to being revised, the chapter on syphilis in particular having been brought into line with modern teaching. The illustrations are also slightly greater in number. It is an easy and pleasant book to read from cover to cover, the cross-referencing being particularly satisfactory. Moreover, the diseases are classified under the parts of the body which they affect, so that the practitioner must find it an invaluable book of practical reference.

The illustrations, though abundant, are variable. Coloured plates

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of skin diseases at best are still misleading. In Plate II., for example, there is too much green colour, and in Plate III. the red is too vivid, while the coppery tinge is absent. The ordinary photographs would be much more telling were the printing upon highly-surfaced paper. It is a pity that many of the excellent prescriptions are still written in a mixture of English and Latin. Nevertheless, the book is excellent and full of attractive hints and suggestions to the practitioner.

Diagnostic and Therapeutic Technic. By ALBERT S. MORROW. Third Edition. Pp. 894, with 892 Illustrations. Philadelphia and London: W. S. Saunders Company, 1921. Price 40s. net.

In this edition the general plan of the work has been retained as in the original. The subject matter deals with a variety of diagnostic and therapeutic procedures in general medicine and special departments most commonly required by the practitioner and hospital resident rather than by the medical student. The methods are set forth step by step and fully illustrated. Details of pathological laboratory technique and of curative major surgical operations are not dealt with.

All the procedures are described with a detail which is not met with in most "clinical manuals," and this enhances its value to the practical man. In the description of intravenous saline administration, however, the frequency with which venipuncture can be carried out for this purpose is not pointed out, but only its limitations as compared with incision and exposure. A chapter is devoted to the Carrel-Dakin technique for infected wounds, and it is permissible to note here no mention is made of the Edinburgh work on "Eusol," etc., which did much to stimulate interest in treatment of sepsis by hypochlorite solutions. The methods of applying passive hyperæmia to different parts of the body are well described and helpful. Exact instructions as to collection of pathological material for investigation are a welcome feature of the book, though at times they are unduly elaborate, e.g., a suction syringe is not always necessary for the female urethra, etc. In connection with blood cultures note might have been made of the necessity of having *various* kinds of fluid media at hand. The usefulness and popularity of the small fæces sample tube with metal spoon is not referred to.

In the special procedures, the various devices are judiciously evaluated, e.g., intubation *v.* tracheotomy. Correct palpation and percussion of such organs as stomach and kidney; urethroscopy; cystoscopy; and enemata as distinct from enteroclysis, are among the many procedures carefully described. The author is to be congratulated on a new edition of such a practical work. There are few of its kind, and it can be specially commended to all junior practitioners.

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Electro-Therapeutics for Practitioners. By FRANCIS HOWARD HUMPHRIS, M.D., F.R.C.P. Second Edition. Pp. x+275, with 67 Illustrations and Glossary. London: Henry Frowde and Hodder & Stoughton. 1921. Price 21s. net.

The second edition of this volume is characterised by the thoroughness and accuracy in which it is written. Based on an intimate knowledge of electro-therapeutics, along with a considerable amount of experience in treatment, the author makes a difficult study comparatively easy to understand. The chapters on radiotherapy and the electrical theory of pain are well worthy of perusal, and throw a new light on several points of great interest—notably the X-ray treatment of malignant disease. Taken as a whole, the present issue of this book is to be highly recommended, and we bespeak a favourable reception for it both by the specialist and the general practitioner.

A Manual of Bacteriology. By R. TANNER HEWLETT, M.D., F.R.C.P., D.P.H. (Lond.). Seventh Edition. Pp. xxxi+807, with 68 illustrations.

The text of this book, now in its seventh edition, has been extensively revised and additions made. From these, in several sections, the reader will gain information hitherto difficult to find in a concise form. A clear account is given of the microscope and its use, including the method of dark ground illumination. The subject of hydrogen ion concentration in connection with the standardisation of culture media is dealt with and a simple mode of procedure described. Dreyer's "standard agglutination method" is given in detail, and also the rapid method of macroscopic agglutination by Garrow's agglutinometer. Fildes' and McIntosh's technique for carrying out the Wassermann reaction is described in full and the author's adaptation of the method to small volumes. Other useful inclusions are the system of classification of bacteria as proposed by the American Committee; Holman's classification of streptococci; and Winslow, Klizler and Rothberg's tabulation of the aerobic from negative intestinal bacilli.

A Text-book of General Pathology. By J. MARTIN BEATTIE, M.A., M.D., and W. E. CARNEGIE DICKSON, M.D., D.Sc., F.R.C.P. Second Edition, Pp. xlv.+496, with 246 Illustrations. London: William Heinemann. 1921. Price 31s. 6d. net.

In the present volume, the authors crystallise the teaching of the Edinburgh School of pathologists. The book covers the whole field of general pathology, giving a good description of morbid processes and their mode of production, together with an account of naked eye appearances and histological changes. No attempt has been made to

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produce a work of reference, but the matter is presented in a form suitable for systematic study, and a clear distinction is drawn between the essentials and the less important parts of the subject.

The section on tumours is very good, and the difficult subject of immunity is particularly well handled.

Since this text-book first appeared, it has had a well-deserved popularity, and several new impressions have been called for. Recent advances in pathology have necessitated a thorough revision of the text, and, in consequence, a large part of the book has been rewritten, and considerable additions have been made to the chapters on animal parasites and immunity. A new chapter on fever has also been included.

A text-book of pathology must be well illustrated, and this one emphatically is so. The present edition has been greatly enriched by the addition of about eighty new illustrations, mostly prepared by Mr Richard Muir, a sufficient guarantee of their quality. Of special note is the series of beautiful coloured drawings in the sections on inflammation and wound healing.

The book is one that should appeal to teachers of pathology who require a well-arranged account of the subject, and we can thoroughly recommend it to the much harassed student.

Microbiology: A Text-book of Micro-organisms, General and Applied.

Third Edition. Edited by CHARLES E. MARSHALL. Pp. i. + 1043, with 200 illustrations. London: J. & A. Churchill. 1921. Price 21s. net.

In its present edition, this book has undergone revision and rearrangement, and the text has been enlarged, notably in the parts assigned respectively to the "Physiology of Micro-organisms" and "Applied Microbiology." Though primarily written by several contributors as a text-book for agricultural and domestic science students, it can also be recommended to the medical student, who, confining his attention in bacteriology largely to the organisms associated with disease in man, is apt to give little thought to the wider problems involved in bacteriological activities here described in a suggestive and readable manner.

Medical Jurisprudence and Toxicology. By JOHN GLAISTER, M.D., D.P.H., F.R.S.E., Professor of Forensic Medicine in the University of Glasgow. Fourth Edition. Pp. 900, with 137 illustrations. Edinburgh: E. & S. Livingstone. 1921. Price 30s. net.

The fact that Professor Glaister's text-book has reached a fourth edition is a sufficient testimony to the high value placed upon it.

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This honour is indeed well deserved, for from beginning to end the book is packed with the essential facts, with illustrative cases largely drawn from the author's wide experience, and with wise advice and sapient comments on the questions discussed. Indeed this last is the real feature of the book—it is the very man himself: every line of it displays the personal touch—no hearsay, no echo of someone else's opinions, but the garnered harvest of ripe experience and of individual work. A valuable feature is the plain explanation of such matters as the powers of the Courts in reference to habitual drunkards, the law of certification as it works in Scotland and in England, the rules regulating the presence and conduct of medical witnesses. The wise advice of the author in regard to the actual evidence and the behaviour of the medical witness in the box should be read, marked, learned, and inwardly digested by every practitioner who would save himself from much trouble and make a proper impression upon a Court.

The least satisfactory feature of the book lies in the illustrations, which are certainly not on a level with the high value of the letterpress, but this criticism is a testimony rather to the value of the book than to the mediocrity of the illustrations.

The orderly arrangement under sections and headings is a valuable feature, which never degenerates into "cram," and a particularly pleasing quality is the simplicity, clarity, and elegance of the language employed throughout. This edition is somewhat larger than the previous one, and includes explanations of certain recent legislation and decisions.

Manson's Tropical Diseases: A Manual of the Diseases of Warm Climates. Edited by PHILIP H. MANSON-BAHR, D.S.O., M.A., M.D., M.R.C.P. Seventh Edition. Pp. xvi + 960. with 462 Illustrations. London: Cassell & Co., Ltd. 1921, Price 31s. 6d. net.

Manson's *Tropical Diseases* was first published in 1898, and during the following twenty-one years were issued six editions and eleven reprints. The present edition contains about the same number of pages as the last, but as the pages are larger, space has been found for much new matter. Many new diagrams have been added, and fourteen of the twenty-seven plates are new. The editor, who acknowledges his debt to the original author ("who has given freely of his ripe experience"), is to be congratulated on producing a new edition clear and concise in style and thoroughly practical in its treatment of the problems presented to the practitioner in the tropics.

There seems no need to retain, in the account of malaria, the

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view (p. 21) that macrogametocytes can reproduce parthenogenetically; the true nature, as shown by Dr J. S. Thomson, of the appearance interpreted by Schaudinn as parthenogenesis is given in a preceding page. Is it strictly the case (*e.g.*, as regards Queensland) that, as stated on p. 603, "where elephantiasis abounds there the filaria abounds, and *vice versa*"? The table on p. 870 does not enable one to differentiate the genera *Pulex* and *Xenopsylla*. The illustrations are well chosen and few of them call for criticism. As Fig. 84 represents a culicine the scutellum should have been trilobate; the larva shown in Fig. 193, if it be a calliphora, is not taken from a typical specimen.

Principles of General Physiology. By WILLIAM MADDOCH BAYLISS, M.A., D.Sc., F.R.S. Third Edition. Pp. 862, with 261 Illustrations. London: Longmans, Green & Co. 1920. Price 28s. net.

This volume presents in an admirable manner the essential principles of physiology, and is not only a work of educational value but one of delightful interest. That it meets a demand is sufficiently evidenced by the rapid appearance of another edition.

The various chapters deal with such subjects as protoplasm, colloidal state, osmotic pressure, catalysis and enzymes, nutrition and reflex action. Where more than an elementary knowledge of the basic sciences of chemistry and physics is necessary for the proper understanding of physiology, that knowledge is provided.

At the end of each chapter a summary of the main points is given and serves to emphasise the more important facts. A bibliography is appended and furnishes the student with facilities for carrying his studies further. In this the third edition, apart from the addition of a section on capillary circulation, little change has been made.

Syphilis and Venereal Diseases. By C. F. MARSHALL, M.D., M.Sc., F.R.C.S., and E. G. FRENCH, M.D., F.R.C.S. Fourth Edition. Pp. xii + 434, with 9 Coloured Plates and 93 Illustrations. London: Baillière, Tindall, & Cox. 1921. Price 25s. net.

Syphilis and Its Treatment. By WILFRED S. FOX, M.A., M.D., B.C. (Camb.), M.R.C.P. (Lond.). Pp. vii + 195, with 53 Illustrations, including 14 Coloured Plates. London: H. K. Lewis & Co., Ltd. 1920. Price 36s. net.

Syphilis. By LLOYD THOMPSON, Ph.B., M.D. Second Edition. Pp. xix + 486, with 81 Engravings and 7 Plates. Philadelphia and New York: Lea & Febiger. 1920.

Many additions to the literature of syphilology and venereal

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diseases have appeared recently, the latest published being treatises by C. F. Marshall and E. G. French, Wilfred Fox, and Lloyd Thompson.

Syphilis and Venereal Diseases by Marshall and French has reached its fourth edition. Much new material has been added and the chapters on the treatment of syphilis brought up to date. The authors prefer intravenous administration of the arsenical remedies to either subcutaneous or intramuscular methods, and recommend the combined administration of salvarsan and mercury. The chapters on inherited syphilis are illustrated mainly from Leonard Finlay's work, and the treatment recommended is chiefly that of Adams and Finlay. The later chapters deal with gonorrhœa, and the authors advocate intravesical irrigation in practically all cases whether anterior or posterior, a method which will not find favour with all urologists. The standards laid down for cure are not so explicit as one would like, and rather too much stress is put on the presence of filaments in the urine. The reader, however, will find in this work a very complete and readable exposition of the subject. It is well printed and illustrated.

In Syphilis and Its Treatment Wilfred Fox gives us the accumulated experience of his work at St George's Hospital and the Seaman's Hospital, Greenwich. He deals mainly with the cutaneous manifestations of the disease, and this aspect of the subject is carefully written and the illustrations amplifying the text are good. The other manifestations of the disease are dealt with too briefly and in some cases omitted altogether. The early diagnosis of neuro-syphilis is not discussed, and the treatment of this condition indicated very incompletely.

In the chapters on general treatment the author omits mention of filtration of the arsenical preparations and of the importance of giving the solution immediately after mixing. In speaking of the Wassermann test there is no indication as to what period should elapse after treatment before the test is taken. These may be minor points but are all important to the student. There are useful chapters on syphilis from the public health point of view and on the management of a clinic for syphilis. A less ambitious title would have been better as the work is far short of a complete treatise on the subject and gives the reader a wrong perspective of the importance of the dermatological aspect of the subject.

Syphilis by Lloyd Thompson is a very comprehensive and concise work. The earlier manifestations are carefully described, and systematic descriptions are given of syphilis of the various systems and organs of the body. Both clinical and laboratory diagnosis

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are dealt with in a very complete and thoroughly practical manner. The methods of treatment are carefully described, and those indicated for which the author has a preference. The teaching is consistently good, the text is well illustrated, and the profession will find in this volume one of the best monographs yet published on the subject.

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In *Practical Chemical Analysis of Blood*, by Victor C. Myers, M.A., Ph.D., New York (Henry Kimpton, 16s. net), an account is given, with considerable detail, of the determination in the blood of the non-protein nitrogenous constituents, sugar, cholesterol, chlorides, and carbon dioxide combining power. The methods described are such as lend themselves, by their simplicity and rapidity, to clinical application. Thus colorimetric methods are employed wherever possible, and, for the estimation of the carbon dioxide combining power, the only method mentioned is that of Van Slyke. The clinical and prognostic significance of variations of the different constituents of blood is discussed, and numerous tables are given of results obtained in pathological conditions. These tables, and the full bibliography, will form two of the most useful features of the book, which should certainly be of value to pathological chemists.

In the new edition of *The Physiology of Protein Metabolism*, by E. P. Cathcart, M.D., D.Sc. (Longmans, Green & Co.), an account is given of the work which has been done in the past few years, in the branch of physiology, by American observers. A new chapter is also included which summarises the evidence in relation to the influence of carbohydrates and fats on protein metabolism.

We have again to welcome the annual *Collected Papers of the Mayo Clinic* (vol. xi., 1919), (W. B. Saunders Company), so ably edited by Mrs Mellish. This publication occupies a place all its own as a record of concerted scientific work in clinical surgery.

The 39th volume of the *Medical Annual* (John Wright & Sons, Ltd., 1921, price 20s. net) is on the same high standard as its recent predecessors. It reflects the return of medical activities to more normal conditions, and while it clearly indicates the lessons that have been learned from war experience, the purely military aspects of medical practice and research have now taken a back place.

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Space prevents a detailed reference to the contents of this volume: suffice it to say that no practitioner who desires to keep abreast of medical progress can afford to do without it.

The Spleen and some of its Diseases, by Sir Berkeley Moynihan (John Wright & Sons, Ltd., price 21s. net), is the Bradshaw lecture delivered before the Royal College of Surgeons in 1920. It is a valuable summary of current knowledge on the physiology, pathology, and clinical aspects of the organ illustrated by a number of ingenious diagrams which serve to demonstrate the varying role of the spleen in the production of different diseases and the blood changes associated with them.

The second volume of Professor Duret's *Traumatismes Cranio-cérébraux* (Felix Alcan) has now been issued. It deals with the cerebro-spinal fluid and concussion of the brain in a most exhaustive manner, no fewer than 1340 pages being devoted to the subject. The complete work is truly monumental.

The Anatomy of the Nervous System, by Stephen Walter Ranson, M.D., Ph.D. (W. B. Saunders Company, price 32s. 6d. net), is a clearly written and well-illustrated account of present-day knowledge of the nervous system. It commences with a short description of the phylogenetic and the ontogenetic development of the system followed by a similarly short, but sufficient, description of its general histogenesis and its subdivisions. Thereafter, in all the subsequent discussions of the various parts of the system, an explanation of the external form and the macroscopical anatomy precedes the description of the more minute structure, therefore the book is well adapted for the use of students.

Professor T. B. Johnston has been very successful in his *Synopsis of Regional Anatomy* (J. & A. Churchill, price 12s. 6d. net). The student will find here everything he requires when revising for his examinations. The book is intended to be used in the dissecting room, and therefore with the exception of a few diagrams of the central nervous system, no illustrations are given. The old terminology is used throughout.

Dr C. R. Whittaker's *Manual of Surgical Anatomy*, third edition (E. & S. Livingstone, price 15s.), should be as popular as previous editions. It has been slightly enlarged, new illustrations added, and the text shows signs of careful revision. Anatomical descriptions are clear and though somewhat brief in places, contain such detail as is of surgical importance. The description of the actions of individual muscles on joints has been simplified by following the lines of recent

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work on that subject. Excellent radiograms of adult joints are included, but it might have been instructive to have given one or two showing the bones prior to the union of the epiphyses. The old terminology has been adhered to, and though this may tend to limit its use by the student using the B.N.A. nomenclature, many will find this volume of value when revising their anatomy from a surgical standpoint.

Impotence and Sterility with Aberrations of the Sexual Function and Sex Gland Implantation, by G. Frank Lydston, M.A., D.C.L. (The Riverton Press, Chicago, price \$4), is written with the purpose of presenting in permanent form the author's hormone theory. Certain features of his experimental work are given in detail. In general, all morbid conditions in which malnutrition exists are likely to be benefited by the sex hormone, which is a powerful physiological cell stimulant and nutrient. The author admits that he does not know why the ingestion of living cells should so act, but he is convinced of its benefit in sexual neurasthenia and other psychopathies. All hormone producing glands from dead bodies are available sources of material for hormone therapy. So too are emulsions of these glandular organs. They act in the same way as implantations but in less degree, and are, the author thinks, superior to so-called extracts and to desiccated substances from the glands of the lower animals. The work on sex gland implantation is original and may be of therapeutic value but will necessarily be limited in its scope.

Types of Mental Defectives, by Martin W. Barr, M.D., and E. F. Maloney, A.B. (H. K. Lewis & Co., price 16s. net), consists almost entirely of a collection of illustrations of various types of the mentally defective with descriptions, which vary from a few lines to a few pages, of each case. The types are arranged in accordance with an educational classification of defectives, the four groups of which do not accord exactly with the four groups of our Mental Deficiency Acts. The book is not a text-book but may be recommended as a useful addition to a good text-book. The most obvious criticism is that the illustrations are too small. Some of them measure only $\frac{3}{4}$ in. square.

Lectures on Tropical Ophthalmology, by R. H. Elliot, F.R.C.S., Lt.-Col. I.M.S. (retired) (Henry Frowde and Hodder & Stoughton, price 3s. 6d. net), is a summary of a short course of lectures delivered by Colonel Elliot at the London School of Tropical Medicine on the subject of it which treats. It is merely the skeleton upon which his larger book on *Tropical Ophthalmology* was based, and has been published apparently as an *aide-mémoire* for the convenience of post-graduate students attending his classes. Its contents are sufficiently indicated in the review of the larger volume published in our issue of December 1920, pp. 400-1.

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November 1921

THE RELATIONSHIP OF A GENERAL CONTRACTION OF THE ARTERIES TO THE STATE OF SHOCK.

By JOHN D. MALCOLM, F.R.C.S.

IN many conditions, normal as well as abnormal, the arteries generally, and primarily the arterioles, contract and the blood-pressure in the aorta rises. The wide stream of the distal circulation is divided into numerous small channels, and each of these is in the grip of a continuous series of circular muscle fibres, concerning which Lister wrote that "it is impossible to conceive a more efficient mechanism for the constriction of a tube than is provided in these minute arteries."¹ The power of a general contraction of the arterioles and of the medium-sized arteries is therefore very great, and certain effects which must inevitably follow such a general contraction have not received the attention they deserve.

When a striped muscle like the biceps is actively constricted it becomes shorter, wider, harder, and altogether more obvious in proportion to its physical fitness and the degree of its contraction. Unstriped muscle fibres become shorter and wider when they contract, but they do not obviously harden. A contraction of the bowel may cause distension of the part above the contraction, if this part is distended by fæces. A piece of colon in this condition, and chronically inflamed colon, may be easily felt, but contracted empty healthy intestine below a complete occlusion of the bowel is soft and flaccid, and very difficult to recognise through the abdominal wall. The irregular active contractions of the small intestine sometimes seen when the abdomen is opened, do not cause tension of the gut above, and do not cause hardening that can be detected. Peristaltic efforts which do not effect a propulsion of the bowel contents are painful, and may, no doubt, cause hardening of the contract-

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ing part if it contains fæces, but when there is no resistance to contraction of the bowel, there is no pain and no hardening.

So in the blood-vessels contraction of the arterioles causes a distension of such vessels as the radials, which therefore become more prominent; but if these latter in turn are occluded by contraction so that the pulse is not felt at the wrist, the vessels cannot be discovered by palpation unless they are atheromatous. The medium-sized peripheral arteries and veins may be so contracted that no hæmorrhage takes place when an incision is made, and yet the vessels cannot be recognised as harder than usual, and often cannot be found until they are exposed by dissection. Thus, whereas contraction of a skeletal muscle makes it more obvious even to casual inspection, contraction of an artery makes it less conspicuous.

Except pallor, therefore, there is no easily recognised evidence of an active contraction of the arteries. Apparently because of this, an absence of the radial pulse brought about by the contraction of vessels of that size, associated as it often is with a fall of blood-pressure, has for the most part suggested the explanation that the blood is drawn away from these vessels by its drainage into some other part of the vascular system which becomes relaxed. This view has been maintained to the exclusion of the possibility that the blood is forced out of the arteries by their contraction. In cases of shock especially it was long believed that the animal bled into its own splanchnic vessels. A dilatation of these vessels was thought to be the primary change. When it became obvious that the splanchnic vessels are not relaxed in the state of shock, this view gave place to the belief that the fall of blood-pressure, then recognised as characteristic of shock, was due to a relaxation of the whole vascular system. The Medical Research Committee has declared that this does not occur, but that the muscular parts of the vascular system are contracted in shock, and now the most authoritative teaching is that the fall of pressure in shock is due to a relaxation of the capillaries throughout the body.

It has been shown by A. Krogh that the capillaries may contract and dilate independently of the state of the arterioles. He treated transparent parts in various ways, and found that "almost all the substances tested, as also local, mechanical and thermal stimulation, produce the same effect on the capillary wall, viz. relaxation of its powerful tone, which it acquires

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again after a period of at least several minutes when left undisturbed.”²

The method of observation was by means of a binocular microscope giving magnifications of 30, 50, and 80 diameters. In consequence of an application of urethane, a “capillary may become filled quite gradually from an arteriole so narrow that the corpuscles are squeezed through one by one. The released capillary may reach a diameter finally of 50μ , and show a peculiar varicose appearance.”³ Mechanical stimulation may lead to stasis in some of the capillaries, until “at last the capillary appears to be densely packed with red blood corpuscles which block the circulation.”

“Mechanical stimulation by pinching almost constantly produces a distinct hyperæmia, with dilatation both of capillaries and arteries, and consequently a rapid current of blood.” As a consequence of pinching the nerves in the frog’s tongue, in certain restricted areas, “the papillæ became so strongly injected that the hyperæmia was distinctly visible with the naked eye.”⁴

That the capillaries can vary in size apart from the size of the arteries is demonstrated, but that a dilatation of capillaries is the primary change in the development of shock is quite another conclusion, which seems to me to have been arrived at not only without sufficient evidence, but in opposition to the evidence.

Clinically the tissues are pale, and show every sign of extreme anæmia in a case of uncomplicated shock. The tissues are so blanched that one of the great difficulties of surgery is to recognise, without examining the blood, whether a man is suffering from shock or from hæmorrhage. Those who maintain that the capillaries dilate in shock, explain the absence of obvious visible evidence of such dilatation by saying that the potential capacity of these vessels is so immense that they can accommodate a vast quantity of blood without showing it. This explanation was suggested to account for the pallor of the tissues when it was urged that the small arteries and veins completely relax and accommodate all the blood; that view is now abandoned, and there does not seem to be any more evidence that the capillaries dilate in shock than there was that the vessels generally dilate. A. Krogh’s observations show that the capillaries as they dilate become filled with blood, and Prof. Bayliss⁵ has said that “the colour of the skin in white races is

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almost entirely due to the blood in the capillaries. When these are empty of blood the tissues are white and cold." In view of such facts, the absolute pallor of the tissues in a state of shock suggests that the capillaries are empty in that condition. The presumption in this direction is at least so strong and obvious that the opposite view cannot be accepted without definite and direct evidence in its favour.

There is one point the importance of which has been overlooked, and indeed the fact itself has to a great extent not been recognised, namely, that in all forms of shock, except those which develop with extreme rapidity, there is at first a rise of blood-pressure in the large vessels. This is certainly true of a slowly developed surgical shock. But typical shock conditions are said by the greatest authorities⁶ to arise from poisons circulating in the blood, and "although recent observers have stated that with the onset of gas gangrene or sepsis there is a sudden fall of blood-pressure, we have been surprised to notice among seriously wounded cases treated by us at an advanced surgical centre a considerable rise of blood-pressure at the onset of aerobic infections."⁷ This rise of blood-pressure in the large arteries at the outset of the development of every form of shock, except those which progress very quickly, is altogether irreconcilable with the teaching that capillary dilatation is the primary change and the cause of the fall of blood-pressure in that condition. Moreover, it has been shown that contraction both of the systemic and of the pulmonary arterioles is caused, immediately and almost simultaneously, by an injection of histamine, and that a primary contraction of the pulmonary capillaries, caused by large doses of this drug, *lowers* blood-pressure in the big systemic arteries.⁸ The fact that an immediate fall of blood-pressure may be produced by contraction of the pulmonary arterioles shows that no dilatation of capillaries or of any other vessels is necessary to bring about a fall of blood-pressure.

It is therefore important to consider the changes which should follow a contraction of the arteries, beginning in the arterioles and extending to larger vessels. If a large number of arterioles and arteries contract, very great changes must inevitably follow because of the fact that a contracted vessel necessarily holds less fluid than a dilated vessel. All that part of the blood which was in the uncontracted vessels, and which in their contracted state they cannot hold, *must* go elsewhere.

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If there is hæmorrhage it is obvious that the blood escapes from the body by bleeding. But an intense general vascular contraction may occur, and may be accompanied by conditions which are almost indistinguishable from those of hæmorrhage although there is no loss of blood. The amount of the contents of the contracted vessels is as certainly reduced by such a contraction as if the blood flowed out of a divided vessel. This is as inevitable as if the contracting power were infinitely great. As soon as the power is sufficient to contract a vessel, it *must* be sufficient to displace the blood in proportion to the degree of contraction.

A contraction of the arterioles is fully recognised as the cause of a rise of blood-pressure in the large vessels, but the effect of a still greater contraction of the arteries is not described or considered in the text-books. The reader is left with the impression that the greater the contraction the greater will be the rise of pressure. Contraction of the arterioles generally and a rise of blood-pressure are known to be caused by stimulation of a sensory nerve, and in other ways ; but if the stimulation is continued and a fall of blood-pressure arises it has been generally assumed, without sufficient reason, that there must somewhere be a relaxation of the vascular system.

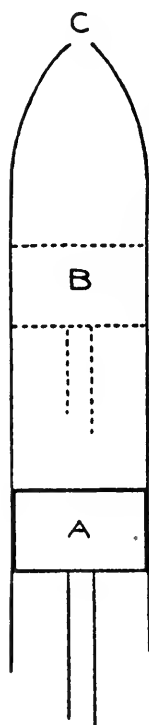
There are many kinds of cases,* including a slowly developing shock, in which from various causes the arteries contract and the blood-pressure in the large arteries rises, and yet when the causes of the contraction are sufficiently persistent or powerful, the rise of blood-pressure invariably gives place to a fall. I suggest that the secondary fall of blood-pressure is exactly what should be expected as a consequence of persistent arterial contraction. The pressure should fall *because of and as a consequence of a persistent contraction of the blood-vessels*. To allow of the contraction and the fall of pressure, it is necessary that fluid should leave the vessels.

It seems to be assumed, but it is not true, that pressure upon a fluid always causes a rise of pressure by the fluid upon the thing which presses upon it. When pressure is made by a piston upon water which fills a syringe with a narrow nozzle, placed and maintained in an upright position, as in the figure, the result is a rise of pressure within the syringe in proportion to the rapidity of the upward movement and the degree of narrowing of the nozzle. But if the piston is forced from the

* I hope to publish further notes of these conditions elsewhere.

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position A to the position B and then comes to rest, although the pressure in the upper part of the syringe may be great when the piston is moving, there is no change, after it comes to rest, in the pressure of the fluid upon the sides of the syringe above B, so long as the syringe is in the upright position, because there is no change in the height of water at C. On the other hand the pressure of water *upon the piston* when it comes to rest at B is *less* than when it was at A, because the



height of water above it is reduced. These changes are possible because fluid escapes from the nozzle. If the nozzle were closed so that no fluid could escape, pressure upon the piston would raise pressure everywhere within the syringe, but the piston could not be raised unless the water leaked. Whether the pressure upon the piston falls *whilst it is being pushed up* or only when it comes to rest, depends upon the rate of its ascent and the freedom with which the water escapes from the nozzle. If the ascent of the piston is sufficiently slow, the pressure of water upon it will fall as it rises. If the escape of water is sufficiently rapid, the pressure of water upon the piston will fall as it rises. The chief factor regulating the fall or rise of the pressure upon the piston is the facility of escape of the water. The fact is indisputable that as a final effect of pressure by the piston upon the water the pressure of the water upon the piston is lowered. Again, when water flows through a tube, pressure upon the sides of the stream, by pinching if the tube is made of rubber, or by turning a stopcock, causes a rise of pressure up-

stream from the point of pressure and a fall of pressure down-stream from that point.

It follows that whilst contraction of any part of the vascular system must *tend to* produce (1) a rise of pressure throughout the whole vascular system because the blood is in an enclosed space, it must also *tend to* produce (2) a rise of blood-pressure up-stream from the point of contraction, and (3) a fall of blood-pressure down-stream from the contracted vessel.

If the quantity of fluid in the vascular system is constant, contraction of some of the vessels must cause dilatation of other

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vessels. It is argued that in shock,⁹ "if the blood is not in the arteries and not to any great extent in the veins it must be in the capillaries." But it is now generally recognised that the blood becomes concentrated during shock, the number of blood cells being so increased as to indicate sometimes a diminution of the amount of fluid in the vascular system equal to 40 per cent. of its original volume.¹⁰ This, in decerbrate cats, is a fatal loss.¹¹ It is therefore not a correct deduction that, because the blood is not in the arteries and not to a great extent in the veins, it must be in the capillaries. It is quite certain that the displaced fluid may, and, in great part if not altogether, does, leave the vascular system in the state of shock. It is therefore possible that the blood may be displaced from the heart, arteries, and veins, and yet the capillaries need not dilate.

The effects of the fact that the blood in the vascular system moves, may be further considered with advantage. The blood stream follows a continuous course through the systemic and pulmonary vessels, its movements being created and reinforced as it passes through each ventricle. The circulation may be regarded, therefore, as consisting of two streams, one beginning at the aortic valves and terminating at the right auricle, the other beginning at the pulmonary valves and terminating at the left auricle.

A contraction of the arteries beginning in the arterioles which is now under consideration, therefore affects the middle part of the systemic blood stream. This is accompanied by a contraction of the pulmonary arterioles, which is necessary to preserve the balance between the pulmonary and systemic systems. Whether this is created at the same time as the contraction of the systemic arterioles or is a reflex effect need not be considered. The fact is proved by the observations of Dale and Laidlaw,¹² and of Roy and Adami.¹³

The well-recognised usual rise of blood-pressure in the large arteries caused by contraction of the small arteries, is accompanied by a responsive increase of power in the ventricular contractions—an augmentor action. This tends to raise blood-pressure in the large arteries still higher, but the antagonism between the arterial contraction and the ventricular force is not pursued to an extremity. If a metal arrangement and a perfect pump, always sending out the same amount of fluid, were under consideration, instead of the heart and arteries, a narrowing of the distal part of the tubes would raise pressure in the proximal

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part, and would increase velocity but diminish pressure in the narrowed parts. It is assumed that the fluid could get away beyond the narrowed tubes as easily as before the change in their calibre.

But it has been shown by Roy and Adami¹⁴ that in the blood-vessels, when aortic pressure becomes sufficiently high, the heart-action, which is at first increased in power, again alters. By vagus action the pressure is raised backwards along, that is up, the stream, exactly as if the ventricles and their pumping force did not intervene. Less blood is propelled into the arteries, and there is a fall of blood-pressure in the aorta, accompanied by a rise in the large veins.

The heart, therefore, is not comparable to a metal pump by which the same amount of fluid is always sent out. The heart and arteries are comparable to a metal arrangement in which the amount of fluid sent out is for a time maintained in spite of opposition to its flow, but is reduced by a greater opposition. When the amount of fluid sent out is reduced because the small distal tubes are replaced by a smaller set, pressure is raised in the larger tubes, the total flow of fluid is retarded, and pressure in the small tubes is lowered. A replacement of the whole of the tubes by a smaller set, if the power of the pump is at the same time sufficiently reduced, would lower pressure in all the tubes. This lowered pressure in all the tubes and diminished flow of blood are the conditions of the arteries and heart when vagus action has fully developed. These changes are possible only if the amount of fluid in the arteries and heart is reduced. There is no doubt that in a case of well-developed shock the amount of fluid in the arteries is reduced, the blood-pressure in them is low, and the output of the heart is diminished. It might be surmised that these conditions, when they are caused by an intense contraction of the arteries, would lead to distension of the veins, because the blood must go somewhere and the veins are so much weaker than the arteries. As already stated, a distension of the veins in the splanchnic area was at one time supposed to be an accompaniment of some kinds of anæmia of the superficial vessels and particularly of the state of shock. In one of the reports of the Medical Research Committee,¹⁵ I am credited with the "supposition" that "in shock the lost blood was gathered in the veins." I must at some time have stated my views very badly, for my first observation on this subject was that, in the course of operations upon the abdomen, the tissues

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in the splanchnic area are as devoid of blood as those of the skin in all cases of well-developed uncomplicated shock, and I have never held that any distension of the large veins which may occur is more than a transient condition in these cases. I have no doubt that a rise of pressure of short duration occurs in the veins as in the large arteries during a slow development of shock, but this does not necessarily involve a distension of these vessels. Clinical signs of such changes are rarely found. I have never been able to recognise them in any case of uncomplicated shock, and for evidence of their occurrence I rely upon the observations of others.

G. W. Crile asserted that at one stage of the development of the condition of shock "the arteries were quite empty, the tissues pale, but the venous trunks were everywhere full, alike in the somatic and in the splanchnic areas. There was a manifest transference of the great bulk of the blood from the arteries and capillaries to the veins."¹⁶ This statement is not repeated, nor contradicted, in Crile's second book. It is not easily reconciled with his theory that shock is due to a general paralysis of the vessels, and it seems to be in opposition to the assertion in the immediately preceding paragraph, referring apparently to the same stage of development of the state of shock, that "the venous pressure had sunk so low that the heart received but little blood upon which to act." The assertion that the large veins are full is also directly opposed to the observations of Dale and Laidlaw concerning "histamine shock," in which "the portal vein and its main tributaries are flat and collapsed, being even more conspicuously empty than the vena cava."¹⁷

These various statements may be reconciled with each other, and with the assertion of Roy and Adami that the blood-pressure rises in the large veins when it falls by vagus action in the aorta, if the rise of pressure in the large veins and any distension which may occur are regarded as passing effects of short duration, followed by a fall of pressure as the rise and fall of pressure in the large arteries follow each other.

By the laws of hydrodynamics a rise of pressure in the large veins must continue to raise pressure up the blood stream, that is to say, in the medium-sized and smallest veins, but in the majority of the conditions in which the arteries become tensely contracted there are no signs of venous enlargement or only the slightest signs. On the contrary the veins contract more or less in proportion to the contraction of the corre-

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sponding arteries. When the tissues are incised in a case of uncomplicated shock and the arteries do not bleed, the veins also are bloodless.

It is frequently stated that the low blood-pressure of shock is due to a diminished amount of blood in the veins, diminished pressure in them, and a consequent deficient supply of blood to the heart. All are agreed that the amount of blood in the veins is diminished when the state of shock is fully developed, but the inference that the low blood-pressure in the arteries is primarily due to a lack of pressure in the veins is altogether untenable if the blood-pressure is primarily raised in the veins by vagus action. The correct inference is that the veins contract and cause a fall of pressure. Such a contraction and fall of pressure are possible only if the amount of fluids in the veins is reduced. Roy and Adami state clearly that the rise of pressure in the veins caused by vagus action is due to opposition in front, not to increased pressure behind. But a rise of pressure in the veins does not continue either from vagus action or from shock. Although the pressure falls very low in the veins and they contract until they appear to be collapsed and empty, they must continue to cause a relatively great opposition to the flow of blood into them from the capillaries until the way is cleared in front by a dilatation of the heart and arteries. This explanation of the changes taking place involves the assumption that the veins have a greater power of contraction than they are usually supposed to have. Of this there can be no doubt.

At the same time that a contraction of the arterioles raises blood-pressure in the large arteries, it immediately tends to lower pressure in the capillaries and in the contracted arterioles. But the ordinary estimations of blood-pressure are made from an examination of the conditions in large arteries, and these estimates take no note of the changes of pressure in the small vessels. The tendency to a fall of blood-pressure in the arterioles and capillaries as a consequence of arteriole contraction, although proved beyond all doubt by various recorded experimental observations, has been entirely ignored in considering the interpretation of the conditions arising in the state of shock. It is known that the arteries regulate the flow of blood to the different areas of the body, and recently L. Hill and J. M'Queen¹⁸ have stated very clearly the fact that kinetic energy in the vessels, *i.e.*, the force or

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velocity of the blood stream, is convertible by resistance to the blood flow, into potential energy, as indicated by the lateral blood-pressure.

A fall of pressure in the small arteries and in the capillaries is far more important than the rise of pressure in the big arteries which develops at the same time if the arterioles contract. There is no protection from the effects of a fall of pressure in the arterioles and capillaries when this is caused by arteriole contraction, except by a relaxation of the arterioles. Pressure might be maintained by increased cardiac effort, which, as has been shown, is developed at first, but this leads to a still greater pressure in the aorta, and then, by vagus action, to a diminished cardiac output, a secondary fall of aortic blood-pressure, and a rise of venous pressure.

As arteriole contraction extends to larger vessels the tendency to a fall of pressure in the small vessels becomes greater and also extends to larger vessels. The secondary fall of pressure in the aorta allows the contraction of the arteries to extend to the largest vessels, and the contraction of these large arteries helps still further to throw the rise of blood-pressure back into the veins. As these changes follow each other, the fall of blood-pressure extends to larger and eventually to the largest arteries as they contract, and from these the contraction and the fall of pressure also pass back into the veins. The contraction of the vessels and the fall of blood-pressure are everywhere resisted and restrained by the fact that the blood is in an enclosed system of vessels, and the complete process described cannot possibly develop as a consequence of vascular contraction unless some part of the blood is removed from the vessels in which the contraction takes place. But if fluid leaves the vascular system, the changes described are inevitable consequences of a persistent contraction of the arteries. When the whole arterial system is reduced in size, the amount of blood which the arteries normally contain must be proportionately reduced and the displaced fluid must go elsewhere. It is certain that when the state of shock is well developed much blood has been displaced from the heart, the arteries, and the veins.

Under these circumstances the condition of the capillaries is as follows:—The contraction of the arterioles has reduced the flow of blood into them, and at the same time there is an increased resistance to the flow of blood from them into the

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veins. An increased resistance to the flow of blood through the small veins, when it is not accompanied by their dilatation, must have a powerful effect in delaying the flow of blood into these vessels from the capillaries. A backward displacement of the pressure can hardly take place from the capillaries to the arterioles, because the whole process begins in an arteriole constriction.

It might be thought under such circumstances that the large quantity of blood which is certainly displaced from the arteries, the veins, and the heart, might distend the capillaries. A. Krogh estimated that the capacity of the capillaries of a muscle in action when all are dilated, and their capacity when all are of narrow diameter, is as 700 to 1. There is certainly a potential space in the capillaries in which a large quantity of blood might be accommodated, and the fact that their distension must be due mainly to a back pressure in the veins would lead to a blue rather than to a red discoloration of the tissues.

There are conditions in which evidences that the capillaries distend are unmistakable. In a state of asphyxia every incision oozes blood from its whole surface. It is certain that the capillaries are dilated in these cases. Whatever the exact changes may be in a state of asphyxia, the dislocation of blood can hardly be greater than when the heart arteries and veins are all tensely contracted, and therefore this last condition should also cause obvious signs of distension of the capillaries everywhere, and there should be a free oozing of blood from cut tissues if such a distension occurs. But in the state of shock, although it is now agreed that the arteries, veins, and heart are all contracted and depleted of blood, obvious clinical evidence of capillary congestion is conspicuous by its absence. The tissues are absolutely pale.

That the capillaries are not dilated in that state has often been demonstrated by the accidental occurrence of a state of asphyxia, caused by anæsthetic difficulties in the course of severe operations. When this occurs, however profound the state of shock may be, evidences of an intense distension of the capillaries immediately appear. The whole surface of the body and of any exposed parts becomes of a deep blue colour, and every cut surface oozes dark blood. If the respiratory difficulty is quickly and completely removed, the tissues at once return to their state of extreme pallor. These observations afford clear and irrefutable evidence that capillary dilatation is not an

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important feature of the state of shock. Moreover, there is equally definite evidence regarding the disposition of the fluid which is sometimes described as the "lost blood."

If the quantity of blood is reduced in the heart, the arteries, and the veins, and is not increased in the capillaries, fluid must pass out of the vascular system altogether. The direction in which an escape may take place is obvious. There is only one direction in which, in the first instance, fluid can rapidly pass out of the vascular system when there is no hæmorrhage, no intestinal flux and no increase of urine, and that is into the lymphatics. An intestinal flux is not a feature of shock, and the urine is scanty in that state. The relationship of sweating to shock will be considered.

THE LYMPHATIC SYSTEM.

The capillaries of the blood-vascular system in the lungs are in intimate relationship with the air spaces, and a constant interchange of gases takes place between the blood and the alveoli. Oxygen is taken into the blood, and is one of the chief nourishing elements required by the tissues. Carbonic acid escapes altogether out of the body through the lungs.

The systemic capillaries are everywhere in intimate relationship with lymph spaces through which oxygen and other nourishing materials are conveyed from the blood to the tissues. There is no direct immediate escape out of the body of matter which is useless to the tissues through these lymph spaces. They are continuous with, or in close contact with, lymphatic vessels which convey away all results of interchanges between the blood and the lymph, that are not locally required for the maintenance of the tissues, and are not carried away by the blood. Other lymphatics begin in the intestinal papillæ as blind tubes through which products of intestinal digestion are taken into the body. Numerous branching lymphatics from both these sources anastomose freely, and convey the lymph to the thoracic duct or to the right lymphatic duct which pass their contents into the veins of the neck on each side. The lymphatics are like the veins in being furnished with valves, but they are smaller and much more numerous. The largest, the thoracic duct, is from fifteen to eighteen inches long, and measures about three lines in its greatest diameter.

The lymph in the frog and other amphibia, reptiles and

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fishes, is propelled by contractile organs or hearts. In the mammalia there are no lymph hearts, but the lymph vessels have muscular walls. Beyond each valve in the direction of the lymph flow, there is a dilatation, and around this the muscle-cells, which are usually circular, assume various directions so as to form a network. It seems likely that the contraction of the muscle over these dilatations will, when stimulated, be more powerful than in other parts of the vessels, and that in association with the valves a propelling action may thus be provided. In the lymph spaces there is neither muscular nor elastic tissue. The lymph, however, does flow out of these spaces into the lymphatic vessels, and the existence of a contractile power acting under nervous control, even in the lymph spaces, may be accepted with some confidence. This is the more readily believed since a tone in the blood capillaries has been recognised. If there is even only a pressure-resisting power, the discharge of fluids into the lymphatics, whether caused by pressure or by vital processes, must cause a flow of their contents. The filling of the fetlocks of an old horse which has been made to stand for a long time seems to indicate that a tone is lost by the tissues in certain circumstances, and therefore that normally these tissues have a tone.

One function of the lymphatics seems to be to act as a drainage system by removing all unrequired material from the tissues; another is to act as the chief channel by which the food in the form of chyle is taken into the tissues. At the other end the lymphatics discharge their contents into the veins, and the material so disposed of must be either for the use of the tissues or for excretion. But between the lymph spaces and the lymphatics in the intestinal wall on the one hand, and the junctions of the lymphatics with the veins on the other, all the lymph in some part of its course passes through lymphatic glands, the walls of which contain muscular tissue. Numerous lymphatics also pass into the spleen, the thymus gland, the solitary intestinal glands, the glands of Peyer's patches, and the bone-marrow. In all these there is an exceedingly intimate association between the blood and the lymph, and a constant interchange of contents takes place between the two, accompanied by a development of new cells and other products, and also by a destruction or re-elaboration of old cells and used-up material. It even seems possible that the blood and the lymph sometimes intermingle. In the spleen the small arterial rami

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"lose their tubular form, and continue, in the opinion of most histologists, not in the usual way by a closed capillary network into the veins, but by opening freely into the labyrinthine spaces of the splenic reticulum. From the same reticulum the roots of the small veins arise."¹⁹ In the liver and pancreas also, and in all glands which produce internal secretions, interchanges between the blood and the tissue-fluids take place. For example, there is more sugar in the hepatic veins than in the portal, and it is generally believed that the internal secretions are conveyed directly from the glands concerned in their formation to the blood.

Estimates of the amount of lymph have been made by tying a canula in the divided lymphatic duct, and measuring the flow. From 1200 c.c. to 2280 c.c. *per diem* were obtained. It is obvious that the conditions of such estimates may alter the flow, which presumably varies greatly during digestion, after imbibition of fluids and at other times.

Mann says that "at the outset of shock the lymph-flow through the thoracic duct was slightly increased. As shock developed it might decrease slightly below normal. In character the lymph changed from a color more or less milky to a pale reddish color. Microscopic examination showed many red cells present. The coagulation time was markedly decreased, so much, in fact, that towards the end of an experiment it was almost impossible to maintain a flow from the canula."²⁰ In connection with those observations it should be noted that Mann was not able to induce shock without manipulating the abdominal contents, and therefore inflammatory conditions probably complicated the results stated.

It should be remembered also, that an increased flow of lymph from the opened lymphatic duct does not necessarily indicate that when the duct is closed there must be an increased flow into the veins. If the veins have an unusual pressure within them, or offer an increased resistance because they are contracted, the flow of lymph into them may be reduced. The junctions of the lymphatic system with the veins are guarded by valves, and the opening of these is necessarily a question of pressure. Therefore, at these points the flow of lymph into the blood stream takes place under conditions controlled by purely mechanical forces. The facts which it is chiefly desired to bring out in connection with the subject under discussion are, that the blood-vessels and the lymphatics are in the closest contact at

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numerous points—it may be said at all points throughout the body—and in a great many highly organised structures the contact is especially arranged to facilitate interchanges of contents between the blood and the lymph.

Under these circumstances it is a reasonable conclusion that if the amount of blood in the heart, arteries, veins, and capillaries is reduced, and if it cannot be located anywhere else, fluid must pass out of the vessels into the lymphatics. Actual blood cannot leave the vessels, or those parts, if any, of the glands in which it normally mingles with the lymph, without causing gross lesions which are not characteristic of shock; and except by sweating, which will be considered later, there is no obvious loss of fluid from the body. If tension is relieved in the vascular system by an overflow into the lymphatic system, it is easy to understand that parts only of the blood, the more fluid parts, may in the first instance escape. This may occur very quickly, and as already pointed out, it is known that the more fluid parts of the blood do leave the vessels in the state of shock with great rapidity.

Some teachers favour the view that interchanges between the blood and the tissues depend upon chemical and vital forces rather than upon fluid pressures. Leonard Hill writes that, "although there is no evidence of a higher pressure in the capillaries than in the tissue fluids, this has been generally assumed, and it is supposed that filtration takes place from the capillaries, *e.g.*, in the case of the renal glomeruli, formation of lymph, aqueous fluid, etc., and that œdema is produced by increased capillary pressure and filtration. My (Leonard Hill's) view is that the tissue cells and fluid enclosed by capsules and skin exactly counterbalance any pressure that is in the capillaries, and that the cellular force of imbibition draws fluid out of the capillaries. . . . Œdema is not due to filtration but to obstruction to the flow of blood, leading to want of oxygen and metabolic changes in the cells, which lead to increased imbibition."²¹

The view that the tissue cells and fluids enclosed by capsules and skin exactly counterbalance any pressure that is in the capillaries is open to obvious criticisms. There cannot be any doubt that pressure in all the vessels is liable to considerable variation within physiological limits, and there does not seem to be any reason for thinking that the pressure in the tissues or in the lymphatics varies in the same degree

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or that it varies with, rather than in the opposite direction from, the pressure in the capillaries. Unless the pressure in the tissues varies with and in exact proportion to that in the capillaries, the pressure in "the tissue cells and fluid enclosed by capsules and skin" cannot persistently "exactly counter-balance" the pressure in the capillaries. If a case of severe hæmorrhage is considered, it is known that fluid leaves the tissues and enters the vessels. Conversely, over-distension of the blood-vessels by normal saline solution leads only to a very temporary increase in the amount of fluid in the blood-vessels. In a case of severe hæmorrhage the pressure in the blood-vessels is certainly lowered, and therefore the pressure in the tissues must become relatively high. A sufficient addition of fluid to the blood stream must temporarily raise blood pressure within it, relatively to the pressure in the tissues. In both cases a transference of fluid takes place in the direction required to equalise the disturbed relative pressures, and it seems a fair conclusion that the disturbed pressures are concerned in the redistribution of the fluids.

The idea that such an important and powerful force as filtration is not used in the animal body in connection with the transference of fluids from the blood-vascular to the lymphatic systems and *vice versa* is so unconvincing that I imagine I may have misunderstood the writer or that the statement quoted on page 264 is not his full conclusion. Physiologists are certainly not unanimous in teaching that capillary pressure always exactly balances the pressure in the tissue fluids, for much experimental work has recently been recorded, especially by Prof. Bayliss, which was undertaken with the special object of discovering the fluid best adapted to resist escape from the blood-vessels by filtration.

The whole system of the blood and lymphatic vessels would rather appear to be so designed that the lymphatics shall act as a reservoir in which a temporary excess of fluid in the blood stream can be accommodated when the vascular system contracts, and from which fluid may be rapidly acquired when there is a deficiency in the blood-vessels. The variability in the capacity of the blood-vascular system seems to demand some such arrangement. According to the view suggested in this paper even after the pressure in the large arteries has fallen very low, there must still be a relative rise of pressure

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at the place which counts, namely at the venous ends of the capillaries, until the arteries relax.

If fluid passes from the blood-vessels to the lymphatic vessels, an increased amount of fluid in the latter or in the tissues might be expected, but when the various causes of contraction of the vascular system are considered, it becomes obvious that most of them are associated with excessive sweating, which must remove fluids out of the body and relieve congestion of the tissues. Leonard Hill asserts that a man "may lose 7 lbs. of water by sweating during hard exercise in hot weather."²² Seven pounds are exactly equivalent to half the volume of blood in a man weighing 13 stone, taking the usual estimate that one-thirteenth part of the body is blood. According to Landois and Stirling,²³ life is endangered in adults when one-half of the total blood is lost. Therefore a dangerous loss of fluid from the body may be accounted for by a loss of fluid through perspiration. The danger of a hæmorrhage and therefore of a loss of fluid depends greatly upon the rapidity with which it takes place. The more quickly it occurs the greater is the danger. There is no doubt that an enormous amount of fluid may be lost very quickly by sweating. For instance, in a state of suddenly-developed profound shock the amount of perspiration is usually as great as in any case of hard exercise, and it occurs more rapidly. Therefore it would appear that in the state of shock the amount of fluid in the body can be reduced practically immediately to an extent which is equivalent to that of a dangerous hæmorrhage.

That the vascular system loses fluid to this extent is also proved by the concentration of the blood which has already been mentioned. This double evidence that an almost fatal loss of fluid from the blood-vessels takes place, is altogether irreconcilable with the view that dilatation of the capillaries is the primary and essential cause of shock. If there is a loss of fluid from the vascular system and from the body sufficient to explain the symptoms, there is no reason for supposing that this fluid is stowed away in the capillaries.

It should be noted that sweating does not depend upon the amount of the blood-supply to the sweat glands. On the contrary, excessive perspiration is characteristic of conditions in which the peripheral circulation and the body generally are feeble. Therefore there is nothing inconsistent in the view

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that a deficient supply of blood to the skin is associated with excessive action of the sweat glands. There seems some reason for believing that the materials for sweat formation are supplied directly from the tissues, that is from the lymphatics, to these glands. Sweating can be produced in the foot of a cat when the limb is separated from the body. The action of these glands is certainly influenced, directly or indirectly, by the nervous system, for fear, anxiety, and pain are well recognised causes of profuse sudden perspiration.

Although sweating is a well-recognised clinical symptom of shock, its significance has not infrequently been left out of account in considering the nature of shock. Probably this is because the condition has been so often investigated as it occurs in animals. It is well known that in some animals a profuse salivation takes the place of sweating. Whether an excess of salivation is a feature of shock in these animals has not, so far as I know, been recorded.

Except that I do not find any evidence of capillary dilatation, the explanation of the changes occurring in shock advocated in this paper do not differ greatly from the view of the Medical Research Committee as regards the final effects produced. There is, of course, no doubt about the sweating in human beings. It is obvious that if the capillaries relax, a contraction of the other blood-vessels will help to dilate them. If they become more permeable to fluids the contraction of the vessels will keep up the supply of fluid to escape. On the other hand, if the arteries contract powerfully, a relaxation of the capillaries and increased permeability of their walls will facilitate the escape of fluid which is necessary before the vessels can contract.

But as regards the sequence of events, it seems to me clear that contraction of the arteries is the primary change. We know that every stimulation of sensory nerves causes vascular contraction, and investigation shows that a primary change in the development of shock is a rise of blood-pressure.* The force is obvious and the power is abundant.

On the other hand, the idea that the capillaries dilate to such an extent that they accommodate sufficient blood to create a condition equivalent to that of a very severe hæmorrhage, when there is no hæmorrhage and no sign of capillary dilatation, is

* Abundant evidence of the truth of this statement will be published elsewhere.

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not convincing. Evidence of a power to produce such an effect seems wanting.

Concerning shock Leonard Hill and J. McQueen say that there is a critical blood-pressure level, and "if the arterial blood-pressure falls for long periods much below that critical level, the rate of capillary flow falls much below the normal. The reason for this is obvious. Attempt at compensation is made by increased vaso-constriction, and while by this means succour is brought by increased pressure in the coronary arteries to the heart muscle and to the brain, the capillary field in the body generally, outside these areas, falls from its already low level of a few millimetres of blood-pressure still lower. Vaso-constriction is no cure for an arterial blood-pressure below the critical level."²⁴ That an attempt at compensation is made by increased vaso-constriction is in accord with Dale and Laidlaw's statement that where, as an effect of histamine, the whole capillary network dilates, "contraction of the arteries will mitigate the increase in the total capacity of the system caused by the dilatation of the capillaries, and, by maintaining a high peripheral resistance, will hold up the arterial pressure."²⁵

The idea that in the state of shock blood-pressure falls from a dilatation of the capillaries, and at a later stage arterial contraction holds up the blood-pressure, is altogether inconsistent with the fact that the blood-pressure first rises and later falls. It is also inconsistent with the teaching that the most prompt and important effect of a full dose of histamine, when introduced into the circulation, is an intense contraction of unstriated muscle fibres.²⁶

There can be no doubt about the truth of Hill and McQueen's statements that vaso-constriction is no cure for an arterial blood-pressure below the critical level, and that, in fact, vaso-constriction makes the capillary blood-pressure in the body generally fall still lower than the critical level. But if this reasoning is obvious, it is equally true and it seems to me equally obvious that vaso-constriction cannot, under any circumstances, be a cure for a low capillary blood-pressure. It is the capillary blood-pressure that is important when a patient is at the point of death from shock. Vaso-constriction is a cause of a fall of capillary blood-pressure, and I submit that contraction of the arterioles and arteries is not only the cause of the fall of blood-pressure *beyond* the critical level in the state of shock, but that, acting in exactly

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the same way, and as described in the preceding pages, vasoconstriction is the cause of the fall of blood-pressure to the critical level in that state. That an immediate fall of blood-pressure may take place when shock is very rapidly induced is certain, and there are two possible and sufficient explanations consistent with the belief that the blood-vessels primarily contract. One is that the whole process takes place so quickly that its various stages cannot be detected. The other is that the pulmonary arterioles may contract before, and to a greater degree, than the systemic. The occurrence of this is described by Dale and Laidlaw,²⁷ as an effect of histamine, but the Medical Research Committee has not weaved this fact into the scheme of its explanation of shock as being primarily due to a capillary dilatation.

It is quite out of the question that a slowly induced shock and a rapidly induced shock can have any real differences in their pathology. Therefore the rise of blood-pressure which occurs in the early stages of a slowly induced shock must be regarded as one of its essential features. It follows that a dilatation of the capillaries cannot be the primary change in the state of shock.

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THE TREATMENT OF DIABETES MELLITUS.

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THE older methods of treating cases of diabetes were, on the whole, rather unsatisfactory, depending as they did partly on drugs and partly on dieting. The only drugs that seemed to have any influence on the disease were opium and its derivatives which acted by depressing the activities of the body as a whole. More success attended dietetic measures. It was recognised that the patient was unable to make use of all the carbohydrate in his food and lost a great deal of it in the urine. The aim of the physician was to reduce the carbohydrate constituent of the diet to a point at which waste no longer occurred. Much search was made for a form of carbohydrate that could be taken without ill effects. This led to the introduction of von Noorden's famed oatmeal cure and Mosse's potato cure. In a proportion of cases these methods were certainly of great benefit, unpleasant symptoms disappeared, the patients became more comfortable, and the progress of the disease was retarded if not arrested. Von Noorden,¹ indeed, claimed that patients could increase their carbohydrate tolerance considerably by remaining for some months on a low diet. Many cases, however, did not respond to any form of treatment, complications were frequent and the mortality was great.

A remarkable advance in the therapeutics of diabetes was made in 1913 when Allen introduced his "starvation" treatment.² This method has now been in use for several years, and has met with universal approval. It is pointed out in support of this line of treatment that the carbohydrate tolerance can be definitely increased, and the patient is likely to attain a more liberal diet than under former rules. Complications are now much less frequent, acidosis can be controlled and coma avoided. On the whole, the outlook is much more hopeful than formerly. This fact is strikingly illustrated by some figures from the Massachusetts General Hospital.³ Over a long period of years ending 1913, the average mortality in cases of diabetes was 28 per cent., while in the few years since then the death rate has fallen to 4 per cent. Similar evidence is given by Geyelin⁴ from the records of the Presbyterian Hospital (N.Y.).

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The fasting treatment of diabetes is a triumph for carefully conducted laboratory research. Allen made his discovery while studying experimental diabetes in dogs, and on this based his suggestions for the clinical treatment of the disease. He showed that if a sufficient amount of the pancreas (about nine-tenths) were removed, a severe type of diabetes resulted, glycosuria persisting on all diets. When a larger remnant of the gland was left, glycosuria did not result so long as the dog was kept on a meat diet. If these animals were allowed to feed on bread, sugar at once appeared in the urine but vanished when the diet was again restricted. Another important observation was, that if bread feeding were continued too long in these cases, the glycosuria did not clear up when meat alone was given, and the type of diabetes became then as severe as if a larger portion of the pancreas had been removed. Quite mild cases of pancreatic diabetes could be easily converted into more serious forms by simply feeding the animal on bread or sugar.

Preliminary Considerations.—In order that a clear understanding of the principles underlying the fasting method may be got, some physiological and pathological facts must be considered. All the more complex forms of carbohydrate must be converted into the simple monosaccharids, glucose, and lævulose, before they can be made use of by the body. This process takes place in the alimentary canal under the influence of various ferments. Some starches appear to be broken down more slowly than others, and this will influence the rate of absorption, which, according to the law of Mass Action, depends on the concentration of the sugar present. When the sugar has passed through the bowel wall it is carried by the portal vein to the liver where a certain proportion [probably about half⁵] is at once stored as glycogen; the remainder reaches the general circulation and is eventually taken up by the muscles. This process of assimilation or storing requires the presence of a sufficient quantity of the internal secretion of the pancreas, and the supply of the necessary hormone may be influenced by the state of the pancreas itself, by changes in the other ductless glands which aid or oppose the pancreas, and also by certain nervous impulses. The blood normally contains a small quantity of glucose which in the fasting state averages 0.1 per cent. This circulating sugar is drawn upon during muscular activity, and more glucose is liberated from the liver to replace the loss. An increase in the amount of sugar present in the blood occurs in certain

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emotional states—fear, anger, excitement, etc.—and a hyperglycaemia also follows ingestion of carbohydrate. In the former case the excess depends on a liberation of sugar from the liver under the influence of the glycogenic nerve centre or the suprarenals. The post-prandial increase of blood-sugar arises in another fashion. The rate of absorption of glucose from the bowel is somewhat faster than the rate of assimilation by the tissues, so that a certain amount of sugar accumulates in the blood for a time. The height and character of the wave of blood-sugar during the ingestion of a definite quantity of glucose should give an idea of the relative speeds of the processes of absorption and assimilation. This may be studied by means of the Glucose Test Meal. The fasting level of the blood-sugar is obtained by withdrawing a sample of blood* in the morning when the stomach has been empty for several hours. The patient is then given 100 grams of glucose in 400 c.c. of water, and his blood and urine are examined at intervals of half an hour, for about three hours. From the figures so obtained, the post-prandial rise in the blood-sugar can be plotted out (line A in diagram). The curve usually shows a fairly rapid rise to a maximum and then a more gradual fall. In the normal person the acme is reached in about thirty minutes, the rise is comparatively slight—from 0.1 per cent. to 0.14 per cent. or 0.15 per cent.—and the whole reaction is completed in a little over an hour. No sugar appears in the urine unless the blood-sugar rises above 0.17 per cent. or 0.18 per cent.—the so-called renal threshold. The size and form of the wave depend upon the amount and character of the carbohydrate taken. The assimilation limit for a solution of glucose, that is, the greatest quantity that can be ingested at one time without causing glycosuria, is usually about 200 grams. In many people the limit is very much lower, while, on the other hand, in myxoedema and certain pituitary conditions it may rise as high as 300 to 400 grams. When glycosuria occurs, it means that the power of the patient to assimilate glucose has been surpassed, and the blood-sugar has risen above the renal threshold. If glycosuria follows a dose of 100 grams of glucose the patient is a potential diabetic (see line B in diagram). Since the height of the blood-sugar wave depends on the difference between the rates of storing and absorbing the glucose, it must follow that in those

* Only 2 c.c. of venous blood are required for estimating the blood-sugar by Benedict's Method (*Jour. Biol. Chem.*).

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persons with a low tolerance (slow assimilation) anything that retards the rate of absorption will be an advantage. This effect is seen when 100 grams of glucose is given along with an ordinary meal instead of alone on an empty stomach. The whole curve is then longer, lasting from two to two and a half hours instead of sixty minutes, and its height may be less than usual. The same thing is seen when the carbohydrate is taken in the form of oatmeal or bread. The assimilation limit in the case of these carbohydrates is so high that glycosuria cannot be produced in non-diabetics by feeding on starches. On the other hand, alimentary glycosuria can always be produced in the normal individual if a sufficiently large dose of sugar is consumed in a limited space of time. The diabetic may be looked upon as a person in whom alimentary glycosuria is induced too readily. Neither the glycosuria nor the hyperglycæmia should be looked upon as the disease itself, but merely as symptoms resulting from an inability to store and utilise carbohydrates. The diabetic subject reacts to the ingestion of sugar in exaggerated fashion. Absorption is little interfered with, except that it has to act against a higher concentration of sugar in the blood, but on the other hand, the process of assimilation is extremely slow. Hence the post-prandial curve in diabetes is abnormally high and greatly prolonged (line C in diagram). In a mild case the fasting level of the blood-sugar may be found about normal. As absorption of the sugar commences, the percentage of the blood-sugar rises very rapidly at first, then slows somewhat as it reaches its maximum in about one and a half hours. The subsequent fall is extremely slow. The sugar may remain for a long time just short of the highest point and then gradually diminishes. The summit may be over 0.3 per cent. or 0.4 per cent. and the whole reaction may last for several hours. During the greater part of this time the blood-sugar stands above the level of the kidney threshold and an overflow into the urine takes place. A similar curve is got in the diabetic after an ordinary meal which contains some carbohydrate. Thus it will be readily seen that when the patient takes a second meal the reaction from the first has not yet subsided. In this way sugar continues to appear in the urine throughout the whole day, though it may be absent in the early morning if the blood-sugar curve has fallen below the threshold during the night. Matters are still worse in severe diabetics, for in them, the level

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of the fasting blood-sugar may be as high as 0.3 per cent. and several days' starvation are required for the glycosuria to disappear. The increased tolerance gained during treatment is sometimes very striking. After the same dose of sugar the hyperglycæmia is very much less, and in many cases no sugar or only a trace occurs in the urine where formerly more than half was lost. It should be noted that in many cases of diabetes the renal threshold is high, the level of the blood-sugar rising to 0.2 per cent. or even 0.25 per cent. before glycosuria occurs. This may be a protective mechanism, tending to reduce the carbohydrate waste. The occurrence of a high threshold also shows how the percentage of urinary sugar is a poor index of the state of the blood-sugar.

In treating diabetes it must be remembered that in many cases the damage is not confined to the carbohydrate metabolism but also affects the proteins and fats. There is abundant evidence that, in severe diabetes, when all carbohydrate is withheld from the food, a certain amount of glucose may be formed from some of the protein molecules. In milder cases this conversion does not take place to any extent. Of the three types of food, the proteins are the most essential for the continued maintenance of the body, and care must be taken to see that the patient is not deprived of them for too long.

The metabolism of fat is also commonly defective in a large proportion of diabetic subjects. Fat is a very valuable form of food and yields twice as many calories as either protein or carbohydrate, bulk for bulk, but it burns slowly and requires more oxygen for its combustion. To permit complete oxidation of the fat to take place it is necessary for a certain amount of carbohydrate to be present in the food. The carbohydrate is consumed more readily and apparently aids the combustion of the fat. When carbohydrates are lacking in the diet, the fats are imperfectly broken up and intermediate products appear. These include β -oxybutyric and di-acetic acids which give rise to symptoms of acidosis. Another evidence of faulty fat metabolism is seen, especially in those patients who have been living for a time on a diet rich in fat. The lipæmia that occurs may be considerable, but this is not as dangerous a symptom as the appearance of the products of incomplete combustion in the blood.

It has long been recognised that a close connection exists between obesity and diabetes, stout people being particularly

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prone to develop glycosuria. Recently several American writers,^{3, 10} alarmed at the greatly increased incidence of diabetes, regard obesity as a prediabetic state and counsel that treatment should be begun at this stage.

Too much weight should not be put on the presence of sugar in the urine, since glycosuria of itself is only a harmless symptom. It is the continued hyperglycæmia and the underlying functional difficulty in assimilating carbohydrates which are of importance. When the damaged tissues of the diabetic continue to handle carbohydrate, the storing mechanism is strained to its utmost and rapidly gives way altogether. Proof of this has been obtained by Allen, who found that continued glucose feeding in his diabetic animals soon caused advanced degeneration of the islets of Langerhans in the pancreatic remnants. The obvious remedy is to put the mechanism of assimilation at rest.

Method of Treatment.—Briefly the course of treatment consists in rapidly reducing the patient's diet, then fasting him until the urine becomes sugar-free, and later building up the diet slowly. The object is to raise the patient's tolerance to a point where his urine remains free of sugar and ketone bodies, and he is able to take sufficient food to maintain his nitrogen balance and enough fat and carbohydrate to allow him to work and have some pleasure in life.

Treatment naturally divides itself into stages:—(1) Preliminary observation, (2) Reduction of diet, (3) Fasting, (4) Estimation of tolerance, and (5) Maintenance.

(1) *Preliminary Observation.*—When the patient presents himself for treatment he should be put upon a standard full diet for several days in order that the severity of the disease may be ascertained. It is not necessary for the patient to be kept in bed during this period, but he should be put to bed before the next stage is begun. The total quantity of urine passed during each twenty-four hours is collected and is tested for acetone, di-acetic acid, and sugar. The actual *percentage* of sugar present is of little value, but the *total amount* excreted in the day should always be estimated. The degree of glycosuria is by no means an index of the response the patient will make to treatment, so no prognosis should be made at this stage.

(2) *Reduction of Diet.*—A word of caution is necessary at this point. Acidosis may be caused in a healthy individual

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by simply starving him, and it is much more easily induced in the diabetic subject by the removal of carbohydrates from the diet. Indeed a degree of acid poisoning is often already present before treatment is begun. Since the source of danger lies in the fats, it is usual to withdraw them first from the dietary. On the second day half the proteins are left off, and on the third day the remainder of the proteins and half the carbohydrates are omitted. (In certain cases this process may be prolonged somewhat by eliminating half the proteins on the second day, the rest of the proteins on the third day, and half the carbohydrates on the fourth day. If a great reduction in the output of sugar is now evident this diet may be continued on the fifth and sixth days. If the twenty-four-hour urine be not sugar-free by now, complete fasting may be instituted.)

(3) *Fasting*.—No food is given on the fourth day or the appropriate day according to the rapidity of the treatment, but the patient is encouraged to drink large quantities of unsweetened lemonade or black coffee. (Caffeine diuresis is said to facilitate the removal of sugar by the urine.⁷) Usually the starvation is well borne when the first pangs of hunger, which are seldom pronounced, have passed off. If the patient is in low condition it may be desirable to allow a small quantity of spirits (1 to 4 oz. of whisky). The combustion of this will supply a few calories and does not lead to glycosuria. The duration of the fast depends on the subject. Our rule is to starve for twenty-four hours after the urine is free from sugar, but the time required for all traces of glycosuria to disappear varies greatly. In some cases the patient becomes aglycosuric immediately carbohydrates are withdrawn; in most, however, the urine does not clear before the second or the third day free of carbohydrates. Sometimes much longer is required, but all authorities^{9, 15} agree that the most severe diabetic can be rendered sugar-free by this means. If sugar persists unduly a most careful search should be made for the presence of some septic focus—even a gumboil or a carious tooth may keep up a glycosuria for a long time. Where four days' fasting has not sufficed to clear the urine, give half rations on the fifth day and starve again, intermitting the fast in this way until sugar-free urine has been attained. Once the urine has been rendered sugar-free, no further glucosuria should be allowed to occur; continued freedom from sugar gives the patient a degree of confidence that is of extreme value to him. During the

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period of starvation the urine must be closely watched for the presence of ketone bodies.

(4) *Estimation of the Patient's Tolerance.*—This phase of the treatment is much more difficult than the earlier stages. Individual patients differ so greatly that no uniform plan will suffice for all, but each case should be treated on its merits. In building up the diet again the usual plan is to add the foods in inverse order to their removal—first, a little carbohydrate, then some form of protein, and lastly, fat. Naturally most attention will be given to the carbohydrates. For the diabetic at this stage of his treatment the most valuable food is green vegetable. It has the merit of containing very little assimilable carbohydrate and what little there is can be practically entirely removed by boiling in three changes of water. In addition, it is a bulky material which gives the patient the satisfaction of taking something more filling than coffee, though it adds very little to the calorific value of the diet. One objection to the repeated boiling is that the taste is apt to disappear, but if some meat extract is added to the last water, a fairly appetising dish is produced (Leyton¹²).

The most useful vegetables are cabbage and Brussels sprouts. These, together with spinach, leeks, cauliflower, and tomatoes all have a carbohydrate content of less than 5 per cent. (when thrice boiled, less than 2 per cent.). Beans, peas, carrots, turnips, and onions, and also many fruits and nuts, contain less than 15 per cent. of carbohydrate. These can be added or substituted when the patient has advanced a little farther up the scale. (Very useful tables of carbohydrate values are included in the books of Joslin, Cammidge, and Leyton.) Oatmeal (20 per cent.), as was discovered by Van Noorden, is a valuable form of carbohydrate food for the diabetic, and a small oatcake or a spoonful of porridge can often be taken quite early in the treatment. It probably owes its virtue to its slow rate of conversion into glucose. Many patients are able to take a potato (40 per cent.) or a small piece ($\frac{1}{2}$ oz.) of bread (55 per cent.) at an early date without passing sugar. To avoid glycosuria the blood-sugar must be kept low, and to accomplish this it is important that the carbohydrate prescribed for the day should be equally distributed over the various meals. In refractory cases where the rate of assimilation is low, and yet it is desired to push the carbohydrate, this might be done by giving extra portions midway between the regular meals.

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On the first day after the fast, Allen advises that 10 grams of carbohydrate should be given (*e.g.* in the form of 5 to 8 ozs. of thrice-boiled cabbage). Next day the amount is doubled and a similar quantity of carbohydrate is added daily until the limit of tolerance is reached. Green vegetables and fluids form the sole diet for the first few days. Protein is introduced from the third to eighth day, depending upon the condition of the patient. A small piece of fish or chicken ($\frac{1}{2}$ oz.) may be given and the amount gradually increased from day to day. Meat and eggs are usually withheld until a little later, since they contain a fair quantity of fat. It is not so essential to spread the protein over the different meals, though it is better to do so when larger quantities are taken. In serving these foods it must be remembered that no flour or bread may be employed in making sauces for them. Bacon (20 to 60 per cent. fat) may be given when fats are allowed. The correct time to commence adding fat to the diet depends on various factors. It should be avoided or kept at a minimum so long as any acidosis remains. And it is essential that a reasonable amount of carbohydrate is being consumed before fat is given. When 50 to 60 grams of carbohydrate are being taken without glycosuria, the fats may then be more rapidly increased until 100 to 150 grams of fat are taken daily, provided ketone bodies do not appear in the urine. The increase of fat in the diet must be carefully regulated. It can be most easily controlled when given in the form of cream or as butter used in making a sauce for the vegetables. The amount of fat to be taken depends on the case. If the patient is able to take a fairly large quantity of protein and carbohydrate, the fat will bear a normal proportion to the other ingredients, but where the quantity of carbohydrate that can be safely consumed gives insufficient calories to maintain the general health, it may be necessary to attempt to compensate for this by increasing the fat. This can only be done when there is no acidosis, and in any case, the increase must be closely controlled by regular examination of the urine for ketone bodies. As a general rule, if the amount of carbohydrate that can be tolerated is low, the whole diet must be kept at a low level.

During the period of estimation of tolerance the diet is gradually built up until the patient is taking sufficient to maintain his equilibrium or until sugar definitely appears in the urine. The amount of carbohydrate which will cause

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glycosuria after a short period of undernutrition is not necessarily the greatest amount that the patient will ever be able to take. The tolerance rises in most cases with further treatment, and the first return of sugar may be due to causes acting temporarily—worry, fatigue, excitement, etc.

(5) *Maintenance*.—A fast day follows the occurrence of glycosuria, and after this, if the quantity of food is satisfactory, the patient enters the period of maintenance, keeping his carbohydrates at a slightly lower level than will cause glycosuria. The ideal maintenance diet is one that prevents the patient losing weight but keeps his weight just a little below what is normal for his height and age. The patient must be discouraged from over-eating. It will be found frequently that a patient maintains his weight and vigour much better by remaining on a comparatively low diet provided the urine be sugar-free. The advice and inducement of friends and relatives to increase the diet to the extent of producing even an intermittent glycosuria must be strenuously combated. A fasting day or a half ration day should be given each week and always on the return of sugar. The patient should be cautioned against continually increasing his diet, even if no glycosuria occurs, for this will tend to use up his reserve and strain the mechanism of assimilation. It is a good plan for the patient to weigh himself regularly, for this serves as a guide as to whether the diet is sufficient or not. A patient who continues to lose weight on an ample diet is probably wasting sugar in his urine.

If the patient is intelligent enough the principles of the disease and its treatment should be thoroughly explained to him, and he may be taught how to examine his urine qualitatively and quantitatively. The former is by far the most important, and will serve a great purpose in preventing the occurrence on successive days of glycosuria during the period of maintenance. Very few patients are found who cannot do this after instruction. Where it is at all possible the quantities of the various foods should be prescribed exactly, and a record kept of the amounts given. In this way it is possible to work out the value of the diet in calories and the progress of the case can be scientifically followed. Such accuracy, however, is by no means essential. The weighing of each individual item of food may be dispensed with if the patient faithfully follows instructions given. There is little fear of his overstepping the limits of safety if he makes only small additions to his diet

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under the doctor's orders. The condition of the patient and the record of his weight will indicate when sufficient calories are being given. Several very useful accounts of the "fasting" treatment of diabetes have been recently published, and some of these are in a form that can be recommended to the patient for his guidance. Of these, probably the best is Joslin's *Diabetic Manual*. Cammidge's *Diabetic Dieting and Cookery* is rather more ambitious. Both give details of food values which make variation of the diet a simple matter. *The Modern (Allen) Treatment of Diabetes Mellitus* by Leyton gives precise details for a dietary ladder and is also to be recommended.

The Treatment of Acidosis.—The mode of production and the precautions necessary to prevent the occurrence of acidosis have already been discussed. The first symptom is usually dyspnoea. This manifests itself, not as an increase of respiratory rate but as a great increase in the depth of each respiration as evidenced by forced and heaving respiratory movements. This acidosis is so urgent and dangerous that the glycosuria should be neglected until the acid poisoning has been controlled. On this point all are united, but opinions are sharply divided as to the best method of treating the condition. Joslin⁹ looks upon alkalis as deadly poison in diabetic coma, while many authorities regard them as their sheet anchor. The usual procedure is to give huge doses of sodium bicarbonate by mouth, rectum, or intravenously (2 per cent. in normal saline). Potassium citrate is also useful, because it becomes carbonate in the circulation and tends to cause diuresis. Small doses of alcohol as whisky or brandy are recommended by some. Measures should be taken to promote elimination by all routes. The patient should be kept warm in bed and encouraged to drink as freely as possible. The bowels should be well opened, high enemata rather than cathartics are advised by several writers for this purpose. If these measures are insufficient to diminish the acidosis, intravenous salines or rectal salines should be given. The question of proper diet is of importance. If the patient is fasting, carbohydrate in assimilable form should at once be given. Cammidge recommends oatmeal gruel or steamed potato made into a thin purée. The same end is attained by giving glucose by mouth or rectum (5 per cent. in normal saline), or even intravenously (6 per cent. in normal saline) if the case is urgent. If fasting has not been begun, the

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fats should be at once stopped while the carbohydrates are continued or even increased.

Ordinate=percentage of glucose in the blood.

Abscissa=time in minutes after ingestion of glucose.

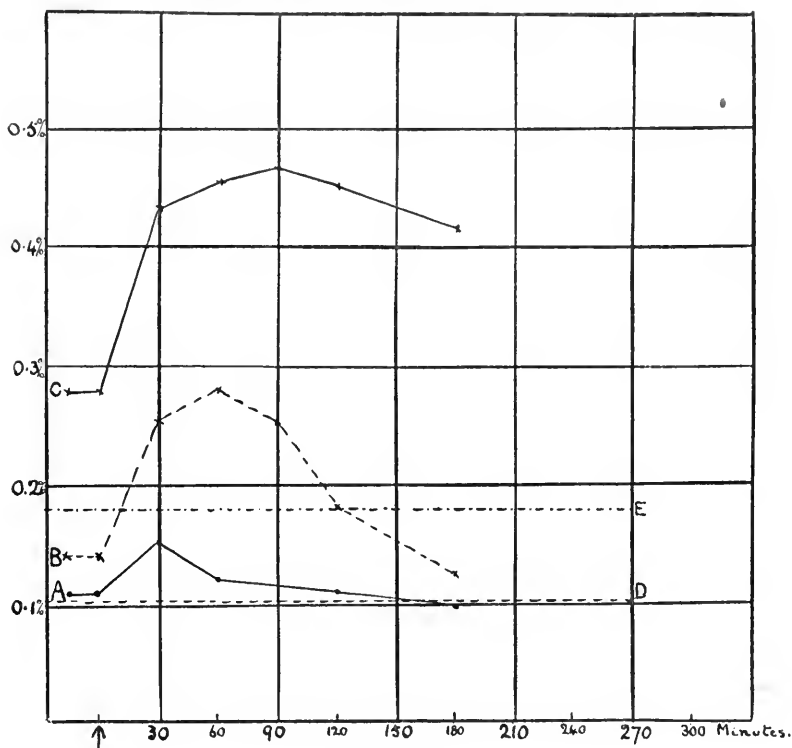


DIAGRAM.

Glucose Test Meal. Blood-sugar reaction to ingestion of 100 grams of glucose (at ↑).

in A=Normal person.

B=Hyperthyroidism.

C=Diabetes Mellitus.

Line D=Average fasting level of blood-sugar.

E=So-called renal threshold.

Glycosuria occurred in cases B and C.

The modern treatment of diabetes has no need for *drugs* except in acidosis, but the dietetic course should be supplemented by certain general measures. The patient ought to live a quiet life as far as possible, avoiding all causes of worry, excitement, etc. Glycosuria can be readily induced in some cases by

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nervous influences. For example, a patient, shortly after he had been discharged from hospital, returned one day in great distress to report that sugar had reappeared in his urine although he had strictly observed all directions regarding his diet. On cross-examination, it turned out that he had been greatly excited over a football match he had been watching the previous afternoon. He was reassured and no further glycosuria occurred.

A considerable difference of opinion exists as to the relative merits of *rest* and *exercise*. Lépine¹³ says that exercise should be avoided as it stimulates the appetite, while Allen and Wishart¹⁹ suggest that exercise increases the assimilation of carbohydrates. Exercise is sometimes recommended as a means of using up the excess of sugar in the blood. In severe cases it is doubtful whether extra sugar can be burnt up in this way, and in mild cases the hyperglycæmia can be more easily got rid of by restricting the intake of carbohydrate. During the earlier part of the treatment, when the patient is fasting or on low diet, he should be kept in bed to conserve his strength as much as possible and prevent his using up the tissue proteins and fats. As the diet increases the patient expects a little more freedom and is the better for it.

The importance of removing *septic foci* is illustrated by the following case. A moderately severe diabetic made practically no progress during a month of treatment, small quantities of sugar persisting in spite of repeated fasts. A number of bad teeth whose roots were bathed in pus were removed and as soon as the sockets cleaned, sugar disappeared from the urine without any further change in the treatment. His further progress to normality as indicated by the assimilation of a gradually increased dietary was uninterrupted.

Various *modifications* of Allen's original method have appeared as the result of several years' experience. Mention of the salient features of some of these may be of interest. Joslin⁸ recommends a comparatively slow reduction of the food before fasting is begun. He then determines the tolerance of the patient for carbohydrates, proteins, and fats separately and in that order. This procedure requires a considerable period to accomplish, and seems hardly necessary. In certain cases the prolonged undernutrition will lead to too great loss of weight, while in others the long time under strict discipline will be a distinct advantage.

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Mosenthal and his colleagues⁶ have emphasised the importance of proteins in the diet, and have pointed out that it is unnecessary to deprive the patient of this element for a long time. This view has been supported by Fenlon,¹⁴ who urges that if protein is kept too low the patient must use up his tissue proteins, and will lose weight, at the same time becoming weaker and less able to resist disease. He, therefore, maintains the protein intake at a moderate level, while the fats are restricted and the amount of carbohydrates is halved daily until glycosuria disappears. By this method Fenlon claims that the tendency to the development of acidosis is decreased since the patient does not need to burn his own fats. Allen in a recent paper¹⁵ confirms this theory, and says that a low caloric diet after fasting may be composed wholly or largely of protein. He adds that "for most cases in private practice it has seemed advantageous to use almost pure protein diets until the blood-sugar falls to normal, and then gradually to build up a maintenance diet to such a level as is possible, without return of hyperglycæmia or marked acidosis."

Mosenthal and Weiner¹⁶ argue that since the milder cases of diabetes do not require the full rigour of the starvation treatment and many patients can not afford to go to bed, the method should be modified to allow them to continue at their duties. Their "ambulant treatment" is designed to meet this. They have constructed lists of the commoner articles of food, and have fixed an arbitrary "portion" of each. Tables of diets are given showing how many portions of each ingredient are required to allow the patient 500, 750, 1000, etc., calories. The scheme appears very simple. It should be remarked that as the patients are allowed to be about, the *periods* of starvation and low carbohydrate diet are replaced by a period of protein feeding.

In cases of severe diabetes, Newburgh and Marsh¹⁷ point out that the possible intake of carbohydrate may be so low that there is a danger of either reducing the patient to inanition or having to allow some sugar to appear in the urine. To overcome this difficulty they recommend a diet that is rich in fat, and in this way a high caloric value can be combined with a low carbohydrate content, *e.g.*, low protein 40 grams, low carbohydrate 30 grams, high fat 170 grams would give 1800 calories. Fenlon believes that a high fat diet causes a decrease in the patient's tolerance towards carbohydrate. A high fat diet

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is also advocated by Petren,¹⁸ who prescribes 500 to 1000 c.c. of cream to his patients daily. He also suggests the use of increasing quantities ($\frac{1}{2}$ oz.) of plain bread as the carbohydrate to be used for testing the patient's tolerance. This could only be employed in the very mildest cases, for in more severe ones the smallest quantity of bread taken would cause glycosuria at once.

The foregoing general account of the treatment of diabetes may be illustrated by the details of an average case.

The patient, a young man of 22, complained of thirst, polyuria, and loss of weight for about a year. Diabetes mellitus was diagnosed. On ordinary hospital diet he passed daily from 1900 to 2500 c.c. of urine, containing 100 to 150 grams of glucose. Positive reactions were given for both acetone and di-acetic acid, but there were no clinical signs of acidosis. The fasting blood-sugar was 0.32 per cent., and after ingestion of 100 grams of glucose a typical diabetic curve was got, rising to a maximum of 0.54 per cent. at one and a half hours. This hyperglycæmia was accompanied by a glycosuria of 4.7 per cent.

Full hospital diet for five days.

16th December.—Fats removed.

18th December.—Meat, bacon, and cheese stopped. Given carbohydrate only (total sugar passed in twenty-four hours—58 grams).

19th December.—Half previous quantity of carbohydrates omitted.

20th December.—No carbohydrate given. Unsweetened black coffee and lemonade *ad lib.* (Polyuria continued though total quantity of sugar had fallen to 28 grams.)

21st December.—Second fast day—8.4 grams of sugar excreted.

22nd December.—Third fast day—urine sugar-free, though both diacetic acid and acetone are still present. Blood-sugar level now 0.182 per cent.

23rd December—1st day of dieting—Fluids as before with two tablespoonfuls of well-boiled cabbage at each meal-time. (Total about 8 ounces).

2nd day—Quantity of vegetable doubled. (Diacetic acid absent.)

3rd day—One ounce of chicken added; cabbage increased.

4th day—As yesterday, with slightly more vegetable.

5th day—A plateful of clear soup at dinner. Quarter of an ounce of butter mixed with the vegetable.

6th day—An egg, lightly boiled, given at tea-time.

7th day—Fluids only.

8th day—Breakfast: Coffee, 2 large cupfuls; boiled cabbage, 8 oz.

„ Dinner: Soup, chicken $1\frac{1}{2}$ oz.; cabbage, 8 oz.

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8th day—Tea: 1 cup of tea; cabbage, 8 oz.; 1 egg.

„ Supper: Tea, 1 cup; vegetables, 8 oz.; 1 orange.

Butter, 1 oz. given with vegetables.

9th day—Meat, 1½ oz., instead of chicken (contains rather more fat).

10th day—A rasher of bacon added at breakfast.

11th day—8 oz. of milk distributed over various meals.

12th day—A second egg added; given at breakfast-time.

13th day—A small oatcake taken at tea without causing glycosuria.

14th day—Fasting.

15th day—As the 13th, with another piece of bacon, a second oatcake, and a little more milk.

18th day—A spoonful of porridge allowed at breakfast. This was increased each day following.

20th day—Sugar returned (5.6 grams in twenty-four hours).

21st day—Fasted.

22nd day—Breakfast: Coffee, 2 cups; bacon, 2 rashers; egg, 1; porridge, 4 tablespoonfuls.

„ Dinner: Meat, 1½ oz.; soup, 1 plateful; cabbage, 8 oz.

„ Tea: Vegetable, 8 oz.; oatcakes, 2; butter, ¼ oz.; tea, 1 cup; egg, 1.

„ Supper: Boiled cabbage, 8 oz.; milk, 10 oz.

„ In addition, 1¼ oz. butter, and 10 oz. milk distributed over the four meals.

*This diet, which gives about 2000 calories, contained less porridge and oatcake than the patient received on the 20th, but these were gradually restored. Half a slice of bread was taken on the 27th day, and some of the green food was omitted, and on the 31st day a small potato was given at dinner-time. Eventually he took a practically normal diet without a return of the glycosuria or hyper-glycæmia.

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STILL-BIRTH: ITS CAUSES, PATHOLOGY, AND PREVENTION.

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(Continued from page 211.)

VI. Pneumonia.

Pneumonia is a common cause of death amongst infants during the first week after birth, and accounted for 21 deaths out of 80, or 26 per cent. I shall only draw attention very briefly to one or two points regarding it.

(1) In the infant there is little defensive reaction as compared with the adult against the infecting agent. In the lung alveoli there are remarkably few polymorphs-nuclear leucocytes present.

(2) Pneumonia in the first few days of life is an extremely insidious disease, generally presenting no characteristic symptoms which might lead to its presence being suspected and to the carrying out of physical examination.

(3) Even at post-mortem examination its presence may be missed, if microscopic examination of the lungs is not carried out. The reason of this, of course, is that a small pneumonic patch, insufficient to alter the normal naked eye appearance of the lung, may frequently be sufficient to kill the infant.

(4) It is sometimes due to antenatal infection from premature rupture of the membranes, and the infant may be not only born infected, but *may be even suffering from an advanced degree of pneumonia before its birth.* This is illustrated by the following case:—

A primipara, at full-time, was admitted to the Royal Maternity Hospital after long delay on the district, due to primary inertia. The membranes had been ruptured for some time before admission. Forceps were applied in hospital and a "blue baby" was born, breathing badly, which died eight hours later. The child was at full-time, very well nourished, and considerably above the average size, 3800 grms. Each pleural cavity contained about 2 ozs. of blood, stained serous fluid, and the lower lobes of both lungs were of solid consistence, and on squeezing the cut surfaces they exuded a yellowish frothy fluid. Microscopically, the lungs showed an advanced degree of catarrhal pneumonia, in the stage of grey hepatisation. At some parts no cells could be made out, and the whole appeared to be a necrotic mass in which even the alveolar walls could not be

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distinguished. Cultures from the lung on blood again yielded an organism of the pneumo-bacillus group. It is impossible that such an advanced degree of grey hepatisation could have taken place in the eight hours in which the child lived, and its blueness and difficulty in breathing at birth, and continuing till death, are strong evidence in support of antenatal pneumonia. Another case, in which the membranes had been ruptured three days before birth of the child, died on the third day, and at post-mortem examination there was found pneumonia, double empyema, and septic endocarditis, the casual organism being the bacillus coli. Breathing from birth had been wheezy and rapid.

(5) I should like to refer very briefly to a type of pneumonia that would seem to be peculiar to the newly-born infant, and which occurred in six of my cases. This might appropriately be called *acute hæmorrhagic pneumonia of infants*, and its course is somewhat as follows :—

A child is born perhaps at the full-time, or a few days prematurely. It seems perfectly healthy at birth, and afterwards, when without any warning symptoms whatever, it is found dead in bed. The face may be blanched, there may or may not be a little blood staining about the mouth and nose, and nothing more is to be seen. Suspicion of overlying or of foul play may arise. What has happened is this. The child's lungs have been infected in some way, and an acute and rapid congestion occurs. In the adult this would be the first stage of a pneumonia, the next stage would be consolidation, followed, if the patient recovers, by resolution. But, in the young infant, the fragile foetal vessels cannot stand the strain thrown upon them by the engorgement, and they give way, blood is poured out into the alveoli and bronchi, and the child dies suddenly, drowned in its own blood, the whole process occurring with dramatic suddenness, and probably not occupying longer than a few minutes.

This "acute hæmorrhagic pneumonia of infants," then, seems to be a distinct clinical and pathological type, and while the ætiological factor in most cases is organismal, there is some evidence to support the theory that it may occasionally be of the nature of an anaphylaxis.

The important points then to be kept in mind are the necessity for guarding the newly-born infant against infection, and of avoiding, when possible, the premature rupture of the membranes during labour.

VII. Suprarenal Hæmorrhage.

Amongst the 200 cases of still-birth and early infantile death there occurred 18 cases of hæmorrhage into the suprarenal body. In 16 of these the child was born dead, while in one it lived half an hour, and in the remaining one four hours. In the child which lived half

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an hour the hæmorrhage was subcapsular only, but in that which lived four hours, born at eight months by the breech, the hæmorrhage was severe and into the medulla of the left. This case proves that such hæmorrhages are at least not immediately fatal, though it is probable that in this case it proved ultimately so, no other apparent cause for death being associated with it. Of the 16 cases that were born dead the suprarenal hæmorrhage was the probable cause of death in one, no other cause of death being found, while in another it was possibly the cause, but as the organs were congested the cause may have asphyxia, though no subpleural or subepicardial hæmorrhages were present to point definitely to it. The infant was born in a state of so-called "white asphyxia," with the heart beating, but efforts at resuscitation failed. The organs showed no signs of asphyxia whatever at post-mortem examination, and the condition was evidently due to the suprarenal hæmorrhage.

Of the remaining 13 cases there were in connection with all certain associated conditions, some of which might of themselves have been the cause of death. These were as follows:—

Intrapartum asphyxia	.	.	.	.	13
Antepartum asphyxia	.	.	.	.	2
Cerebral hæmorrhage	.	.	.	.	5
Subcapsular hæmorrhage in liver	.	.	.	.	4
Hæmorrhage into lung substance	.	.	.	.	3
" " kidney	.	.	.	.	3
" " spinal cord membranes	.	.	.	.	2
Free blood in peritoneal cavity	.	.	.	.	2

Parity.—Of the 18 cases 4 occurred in primiparæ, 4 in ii-paræ, 2 in iii-paræ, and 8 cases in all the others.

Site of Hæmorrhage—

Into medulla of both	.	.	.	.	5
" " right	.	.	.	.	4
" " left	.	.	.	.	5
Under or into capsule of both	.	.	.	.	1
" " " right	.	.	.	.	1
" " " left	.	.	.	.	2

The subcapsular hæmorrhages were slight in all cases except one, in which there was a large hæmorrhage under the capsule of the right. It is probable that these small subcapsular or intracapsular hæmorrhages, though rather uncommon, should be disregarded as having no morbid effect.

Presentation.—Six cases were delivered by vertex and 12 by breech. Of the 6 cases delivered by vertex, in 13 the hæmorrhage was into or underneath the gland capsule, and in only one of these was it severe. Rejecting, for statistical purposes, the 2 slight cases, there remain 4 cases in which delivery was by vertex. In 3 of these

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the hæmorrhage was into the medulla, and in all into the right only (severe in 2, slight in 1) and in one beneath the capsule.

Mode of Delivery in the Vertex Cases.—Of the 4 vertex cases in which the suprarenal hæmorrhage was severe, all except one were difficult forceps cases. One had flat pelvis, and there had been unsuccessful attempts at forceps delivery before admission, delivery being affected after admission without much difficulty, and the cord being twice round the neck.

Another, a ii-para, was admitted with the head delivered (by forceps), and the shoulders impacted and child dead; cleidotomy had to be performed in order to deliver the body. The child was abnormally large and weighed 5250 grms.

The third case, a primipara, also a stiff forceps, was eclamptic, and had five fits before admission, the child being 3480 grms. in weight, and therefore also somewhat large.

The only vertex case in which spontaneous labour gave rise to suprarenal hæmorrhage was No. 7; the mother suffered from chronic Bright's disease, and the child was killed by antepartum asphyxia. Labour came on spontaneously at 8th month, and labour was easy. The hæmorrhage was into the medulla of the right suprarenal, but was slight in amount, and possibly occurred post-mortem.

Of the 12 cases occurring in breech deliveries the sites were as follows:—

Under capsule of left	.	.	.	.	.	1
Medulla of both	.	.	.	.	.	5
„ right	.	.	.	.	.	2
„ left	.	.	.	.	.	4

That under the capsule of the left was slight in amount and may again be rejected.

Mode of Delivery in Breech Cases.—In 3 cases forceps had previously been tried unsuccessfully, and internal podalic version was then carried out, the extraction being afterwards difficult in every case.

In 2 cases the presentations were originally transverse, and were treated by podalic version. In one the labour was afterwards difficult, the child being unusually large (5320 grms.), while in the other it was easy, the child, however, being premature (8 months), which doubtless rendered hæmorrhage more liable to occur.

In 3 the presentation was originally breech, one of these being a hydrocephalic. In one of these the pelvis was slightly contracted, and extraction in all 3 cases was attended with some difficulty. In one, however, the difficulty was only with the after-coming head.

Of the remaining 3 cases one was at 7 months, one at 7½ months, and the third at 8½ months. Three of these were vertex cases, in

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which internal podalic version was done, in 2 cases for antepartum hæmorrhage, and in the third for albuminuria and pre-eclampsia. In none of these 3 cases was delivery afterwards attended by any difficulty.

Thus, as in the case of cerebral hæmorrhage, if we reject the three cases in which podalic version was carried out because forceps had failed to deliver, as it might reasonably be supposed that suprarenal hæmorrhage would have occurred had these remained as vertex, and assuming that 3 per cent. is the normal percentage of breech births, we arrive at the conclusion that *breech delivery is twenty-two times as likely to give rise to suprarenal hæmorrhage as delivery by the vertex.*

Maturity.—Of the 15 severe cases, 9 occurred in full-time infants, 2 at 8½ months, 2 at 8 months, 1 at 7½ months and 1 at 7 months. Assuming 1 in 10 to be the normal proportion of premature to full-time labours, we find that suprarenal hæmorrhage is *four times as likely* to occur in premature labour as in a labour at full-time.

Causes of Suprarenal Hæmorrhage.—Of the 16 cases of suprarenal hæmorrhage in which the child was still-born, 15 were associated with asphyxia. In 2 of these the asphyxia was of the antepartum variety, both being in premature infants. Although, on account of the fluid condition of the blood after asphyxial death, it is possible that the hæmorrhage into the suprarenal in these two cases occurred from trauma during delivery, yet its causation by the asphyxia cannot be altogether excluded, especially as both infants were premature. It is certain that hæmorrhage over the cerebral hemispheres, around the small veins of the meninges, are frequently found as a result of asphyxia in premature infants, while from the same cause large subcapsular and even interstitial hæmorrhages may be met with in the thymus, even in full-time infants. In the premature infant the vessels are extremely fragile and their muscular and elastic coats improperly developed, and it is possible that they easily give way under the strain of the sudden congestion of the internal organs in asphyxia. In no organ would this be more likely to occur than in the suprarenal, which is extremely vascular, and in which there is a minimum of supporting fibrous stroma. The organ also is so situated—close to the termination of the inferior vena cava—that it is likely to receive the full force of the backward pressure of blood from the over-distended right auricle.

As the left suprarenal vein empties into the left renal vein, while the right enters into the inferior vena cava, it might be expected that fewer cases of hæmorrhage would occur in the left suprarenal capsule. This, however, has not been borne out by my cases, as hæmorrhage into the left suprarenal was never so frequent as into the right.

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In discussing asphyxia, we saw that, so far as conclusions could be drawn from the figures available, breech delivery was nine times as likely to give rise to asphyxia as delivery by vertex, while it is twenty-two times as likely as vertex to give rise to suprarenal hæmorrhage. It would appear from this discrepancy that there must be some other factor than asphyxia at work in producing suprarenal hæmorrhage, and coming much more prominently into play in breech delivery than in vertex. This factor is probably the direct trauma incidental to the passage of the breech and abdomen through the comparatively undilated parturient canal, and the pressure of the child's lower extremities against the abdominal organs.

It has been suggested that the pressure upon the liver compresses the inferior vena cava between the liver and the vertebral column, thus damming back the blood into the suprarenal (Mather); and it is evident that such pressure would be more likely to take place in podalic presentations where the cervix-uteri and vagina have been much less completely dilated by the breech than they would have been by the forecoming head.

Too early ligation of the cord as a cause seems to be ruled out by the fact that the increased pressure would not fall directly upon the inferior vena cava, neither would this cause operate more frequently in breech than in vertex presentation.

Syphilis, being a frequent predisposing cause in hæmorrhage in other organs, as the lung and kidney, would no doubt also predispose to suprarenal hæmorrhage by furnishing a capillary toxin, but it was not present in any of my series.

It would seem, therefore, that while the sudden congestion of the organs occurring in asphyxia, whether ante or intrapartum, may be sufficient to give rise to suprarenal hæmorrhage, a more important factor is the trauma incidental to the passage of the child through the comparatively undilated maternal passages during breech delivery.

VIII. Scopolomorphine Narcosis.

There were three cases in which the cause of still-birth would seem to have been scopolomorphine narcosis. In all three asphyxia and other known causes were excluded, and this was the only method available of arriving at the cause of death, as it was found to be impossible to ascertain the presence and amount of hyoscine and morphine in the tissues of the foetus. All three cases occurred in primiparæ, in all the presentation was vertex, and in all but one the labour terminated spontaneously.

In one case thirteen doses of hyoscine had been administered, the first consisting of $\frac{1}{150}$ gr. and the succeeding doses of $\frac{1}{145}$ gr. every

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hour till the child was born; also morphine every four hours—first dose $\frac{1}{4}$ gr. and succeeding doses $\frac{1}{8}$ gr. In all $\frac{3}{4}$ grs. morphine was given. The child was born in a state of white asphyxia and the heart was beating, but efforts at resuscitation failed. The foetus weighed 3500 grms. Thymus was remarkably enlarged, and weighed 30 grms. Its right lobe extended downwards as far as the diaphragm, while the left reached to within half an inch of it, and greatly overlapped the pericardium, and both lungs lay hidden behind it.

The next case only received two doses of hyoscine, each being accompanied by morphine. The first injected consisted, as before, of morphia $\frac{1}{4}$ gr., hyoscine $\frac{1}{150}$ gr.; the second was given seven hours after the first—morphine $\frac{1}{8}$ gr., hyoscine $\frac{1}{15}$ gr., and the child was born $4\frac{3}{4}$ hours afterwards. The body was white and limp and the heart beating, but efforts at resuscitation again failed. There were no signs of asphyxia, and the thymus weighed 14 grms. (foetus 3340) It was therefore also large, but not so markedly as in the other case.

The third case occurred two days after the last. In this, three doses of morphine, $\frac{7}{12}$ gr. in all, and seven doses of hyoscine in the usual amounts were administered, the child being born spontaneously and dead, 3 hrs. 25 mins. after the last injection. The thymus in this case weighed 22 grms. (foetus 4020).

Thus, in two of the cases the thymus was definitely much enlarged, these two being the largest found by the writer in a series of over 400 post-mortems. It seems as if the enlargement in these two cases were something more than a coincidence. It is possible that there may be in certain cases an undue susceptibility to the action of morphine. Such increased susceptibility is not infrequent in the case of infants and young children, and it does not seem unreasonable to suppose that a like idiosyncrasy may also exist in the case of the unborn foetus; or that, owing to the metabolic processes of the mother being unusually slow, a larger amount of the drug may in some cases be allowed to pass into the foetal circulation; or does the enlarged thymus render the foetus more susceptible to the poison in the same way as status lymphaticus may render it more liable to succumb to the action of other toxins?

Dr Haultain suggests that it is neither the morphine nor the hyoscine, but the combination of the two that constitutes the lethal agent.

In any case, the suspicion that there may be in certain cases an undue susceptibility on the part of the foetus to the action of morphine and hyoscine, or that in some cases a defective metabolism in the mother may allow a lethal amount of the drugs to pass over into the foetal circulation, indicates the need for study of each individual case rather than a routine administration of the drugs at fixed intervals, and especially for careful watching of the foetal heart, for signs of undue rapidity, slowing, or irregularity, although when such occurs

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even rapid delivery may be ineffective in preventing a fatal termination, a lethal dose of the drug having probably been already absorbed.

IX. Premature Birth.

Out of the 200 cases of still-birth and neonatal death 95 were born prematurely, or 47.5 per cent. Of these, 39 were still-births and 56 neonatal deaths.

Bearing in mind that every child should be carried to full-time, unless there is some reason for the contrary, an effort was made to ascertain this reason by a co-ordination of the clinical history of the mother with the post-mortem findings in the foetus, with the following result:—

Causes of Premature Birth:—

Induction of labour	12
Albuminuria (2 with accidental hæmorrhage)	8
Eclampsia	3
Twins	16
Placenta prævia	8
Syphilis	28
Pernicious anæmia	1
Phthisis in mother	2
Cancer in mother (primary scirrhus in breast, secondaries in liver)	1
Prolapsus uteri	1
Severe fall	1
Congenital heart disease in mother	1
Anencephalic	2
Pyelitis	1
Abnormality in cord, causing foetal death and maceration	1
Undiscovered causes	9

95

With regard to the 9 cases in which the cause was undiscovered, in 7 the history was incomplete (district cases). In 2 the most searching examination, including Wassermann tests, failed to reveal any cause for the prematurity. In one of these, however, the prematurity was very slight—not more than 10 days, while the other was born at 8 months. It would therefore appear that in about 2 per cent. of premature births the most careful investigation may fail to reveal any cause for the prematurity.

Causes of Death in Premature Infants.—In the 39 cases of still birth these were as follows:—

Cerebral hæmorrhage	5
Asphyxia	11
Macerated (2 albuminuria, 14 syphilis, and 2 unclassified)	18
Craniotomy	2
Ruptured liver	1
Anencephalic	2

39

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In the 56 cases of neonatal death the causes of death were as follows:—

Cerebral hæmorrhage	22
Syphilis	12
Syphilis, with catarrhal pneumonia	6
Catarrhal pneumonia	5
Septic peritonitis	2
Septic meningitis	1
Suprarenal hæmorrhage	1
Omphalorrhagia	1
Moist gangrene of foot, with cerebral hæmorrhage	1
Asphyxia (gasped a few times)	1
No cause found	4
	<hr/> 56

All these causes of death have been previously discussed under their respective headings.

With regard to the 4 cases in which no cause for death was found at post-mortem examination, it can only be supposed that the infant had insufficient vitality to maintain life, or that fatal cooling of the body occurred through insufficient development of the heat-regulating mechanism. Three of these were at the 7th month and one at 7½ months.

In addition to these causes of death the following lesions were found amongst the 95 cases:—

Interstitial hæmorrhage in lungs	7
" " in kidneys	2
" " in thymus	2
Subcapsular hæmorrhages in liver	5
Extradural hæmorrhages in spinal column	2
Hæmatoma in utero-vesical pouch	1
Hæmorrhage in R. sterno-mastoid	1
Hæmorrhage in R. lobe of thyroid	1
	<hr/> 21

For discussion of interstitial hæmorrhages in lungs, subcapsular hæmorrhages in liver, and measures for the prevention of premature birth, see original paper, Section IX.

X. Miscellaneous.

There were a few cases in which the cause of death fell into none of the above-mentioned classes. Full details of these will be found in the original paper and appendices.

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They may be tabulated as follows :—

Septic peritonitis from cord infection	2
Septic meningitis	1
Omphalorrhagia	1
Neonatal asphyxia	3
Encephalocele with malformation of the heart	1
Anencephalic	2
Double congenital hydronephrosis	1
Ruptured liver	1
Large thymus (status lymphaticus)	1
Deformed chest and rudimentary lungs	1
	<hr/>
	14

The case of double congenital hydronephrosis has been reported by Dr R. W. Johnstone and the writer in the *Transactions of the Edinburgh Obstetrical Society*, 1920-21.

Supervision of Pregnancy.

In conclusion, the great fact that emerges from this investigation is that a very large percentage of the still-births and neonatal deaths could have been avoided by adequate antenatal supervision. Especially is this the case in deaths from craniotomy, asphyxia, and in cerebral hæmorrhage occurring in breech and in difficult forceps deliveries. (Only about 3 per cent. of the 200 cases had undergone adequate antenatal supervision.)

Arguments directed against the preservation of the lives of the unfit certainly do not apply in these cases, for the child that is lost in birth from these causes is generally very large and well nourished, and it is usually just because of this large size that still-birth occurs. Thus, in the cases of craniotomy the average weight of the child without a large part of the brain was 3180 grms.; of the cases of asphyxia in full-time fetuses the average weight was 3480 grms., and the largest weighed 6160 grms., and of the fatal cases of cerebral hæmorrhage in full-time infants the average weight was 3460 grms.

Neither do such arguments apply even in the case of syphilis. If we were certain that every syphilitic infant would be born dead, it might reasonably be contended that such was the best possible solution of the problem; and if we were sure that every infant born with congenital syphilis would, if untreated, die, to allow it to do so might be the best course to adopt, both in the interest of itself and of the race as a whole.

But, fortunately, or unfortunately, we cannot be certain that such a termination will occur, either of the pregnancy of the syphilitic woman or of the life of the congenitally syphilitic infant. The latter may, even if untreated, live to bear in its body the major portion of the punishment of the sins of its parents, and therefore the only justifiable

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course to adopt is the early and adequate treatment of the expectant syphilitic mother, especially as such apparently excellent results in the case of the child are now being obtained with modern methods.

The ideal of antenatal supervision and care of every unborn infant can only be realised by the *compulsory, or better, by the voluntary notification of the pregnancy of every expectant mother.*

Parents of children of school age may be compelled to have remediable physical defects in those children treated. It would seem that such compulsory care of the child may begin too late if only undertaken after birth.

Such conditions as mental backwardness due to small non-lethal cerebral hæmorrhages or tentorial tears occurring during birth cannot be remedied in the child of school age. They could and should have been prevented.

In short, it seems illogical that expectant parents should be allowed to risk the life of their *unborn* child with impunity, whilst the failure to provide even for its physical comforts after birth renders them liable, and rightly so, to the condemnation of the law and of public opinion.

I wish to express my thanks to the Head of the Antenatal Department and to the Physicians and other members of the Staff of the Edinburgh Royal Maternity Hospital, for their cordial co-operation in this research; also to Professor Lorrain Smith for allowing the pathological part of the investigation to be carried out in his department in the Royal Infirmary, as well as for much invaluable advice and criticism.

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A MEDICAL STUDENT'S EXPENDITURE SEVENTY YEARS AGO.

A CONTRIBUTED article to the daily *Scotsman* (25th August) deals with the hardship entailed on students from the middle classes, by the prevailing high price of commodities, and the increase of University fees. The medical student is not specified in particular, but he has certain items of necessary expenditure, which makes his lot even more stringent than that of others. The contretemps is a serious one, but there is that in the Scottish character which will carry the best man forward, be the economic situation never so bad. To those who are facing the music just now, it may be of interest to learn how their grandfathers laid out their home allowances, while attending classes during the session.

For the Winter Session of 1849-50, as a youth of seventeen years, the author of an account book which recently fell into the writer's hands came to Edinburgh to study medicine, and there he graduated M.D. after three years' study. From a middle-class home, his father being a professional man of moderate means, he came with a realisation that time is money, and that time is more easily lost than gained—an understanding which adds an earnestness to our national stability at once the butt and the admiration of the world.

Fees, board, and books are rightly mentioned by the *Scotsman's* contributor as necessary outlay, but it is only when the student comes from abroad that "clothing" has to be taken into consideration. That item is part of the *personal*, not of the *student's* outfit; is not incurred in virtue of the medical curriculum; and is recognised by youth as a parental obligation. It is, as it were, a charge against capital, not against revenue; and the student recognises that what he receives is revenue which entails acknowledgment, whereas the parent is "capital" for which the student is not responsible.

But to our tale. That session commenced on 7th November, and the student left home on the 5th with £20 in his pocket. It is but natural that the first note of expenditure should be for his railway journey, and it is of interest that the ticket then cost within a few pence what it does to-day. One experiences a feeling of revengeful satisfaction, however, on learning that

A Medical Student's Expenditure

the cab-fare from the station to his lodging was but 6d., and as no "tip" is entered, it is pretty certain that for such liberality the cabman uncomplainingly assisted the student to take his baggage upstairs.

Calling-cards were evidently written in those days, not engraved as now, for "Cards and case, 1s." and "Note-books, 2s. 2d." purchased on the following day met the preparation for the session. The opening of classes on the 7th brought heavy outlay, for we find:—

7th.—Lectures on Anatomy.

Perpetual Ticket	£5	5	0
Practical and Demonstrations	4	4	0
Ticket for Chemistry and Pharmacy	3	5	0
Ticket for Natural Philosophy	3	3	0
Gregory's Chemistry (12s. 6d.)	0	5	6
Pocket Note-book	0	2	0

which materially reduced his funds; and with

Board and Lodgings for one week 0 7 9

left him with £2, 19s. 1d., which lasted him till 9th December, when a remittance of 30s. from home enabled him to go on till Christmas. The other academic expenses during that time were, "Registration of tickets, 5s." and "Half a Superior Extremity for Dissection (*sic*), 3s. 6d." Two books were purchased—"Ellis' *Demonstrations of Anatomy* (12s. 6d.), 10s." and "*Harris on Heat and Electricity* (1s.), 10d."; while apparently for relaxation, "*Lights and Shadows of Life* by Dr Wilson (3s.)" he obtained for 2s. 4d. Just before going home for Christmas he had his hair cut, which cost him 3d., but that must have been a special concession, for during subsequent years the item does not reappear at less than 6d.

The recurring entry of "Church 1d." occasionally raised to 6d. at "Quarterly collection" or even to 1s. at "Collection for the Royal Infirmary" shows that he must have been a regular attender in the House of God; a trait which has not since conformed to Mendelian law.

He purchased his first pair of gloves (2s. 6d.) in December 1849, and though these were doubtless worn only on Sundays, they did well, for they are not replaced until exactly two years later at the expense of 2s. During his undergraduate career expense for clothing is not a feature, and "Repairs to clothes 2s. 6d." and "Repair to hat 2s." each occurs on only

Seventy Years Ago

one occasion. Boots, however, were another story. A few weeks after his arrival in Edinburgh we find he expends 2s. in "Soleing boots with gutta-percha and mending ditto," and a few weeks later, "Improving boots by getting iron on heels and toes, 10d." "Soleing" at 2s., "Heeling" at 1s., and "Soleing and heeling" at 2s. 6d. seem to have been the charges during those years. The expenditure of 1s. on a "Loop button" suggests nothing, but that of 6d. for a "Plaid pin" calls up visions of Hugh Miller or of Blackie, and one wonders what students looked like in those days and when they used their plaids.

The "Board and Lodgings" ran per week between 6s. and 8s., and when on one occasion it had risen to 9s. 1d., "including Christmas" is inserted in small writing to explain the extravagance; while on another occasion, when it actually reached 9s. 3d., the explanatory insertion "(Aunt P——)" indicates realisation that relatives' indiscretions are costly luxuries. Daily at midday he had "Bread and milk," and this totalled during the session 5s. His washing cost him 1s. 6d. every ten days.

"Parts" were less expensive then than now. The "Half of a Superior Extremity" has already been referred to, and it, with a "Thorax" at 2s. and a "Leg" at 3s. 6d. seems to have completed his practical anatomy during his first *annus medicus*. The item of 7s. for a head and neck comes early in the following year. Perhaps less was expended by this student on "Parts" than usual, for he was a medalist in anatomy both junior and senior, and being appointed prosector, was relieved of some of that outlay.

At the close of the first session he makes a résumé of his expenditure as follows:—

Total expenses during the Winter Session of 1849-50.

Classes and Subjects	£21 18 6
Lodgings, Washing, etc.	10 9 0
Books and Paper	1 11 7
Sundries	2 10 11
	£36 10 0

Doubtless the dissection of such dead animals as he could get he carried out, but on occasions this had to be supplemented. Thus we find in "Private dissections—Cow's eyes, etc., etc. 1s."

A Medical Student's Expenditure

and in "Sheep's head for dissection 1s." evidence of what he was doing; but the entry in May 1851 "Salmon roe 7s." suggests, not work, but that he had his father's instinct, if not his ability, as a fisher.

"Oysters, biscuit, etc., 2s. 6d." remind us that times have in some ways changed for the worse, and one sees "stout" not "chablis" in the "etc." For "Private tuition in French," his class *and* books cost but 8s. Even *now* we would like to find that Frenchman!

Our student does not appear to have returned for the Summer Session of 1850, but the following Winter Session found him again at anatomy and surgery. Much serious consideration must have been given to the expenditure "Portraits of Professors, 9s.," but no doubt he found them as stimulating as the student does to-day. The initials of the friend whose visit raised his board and lodging one week to 10s. are inserted in brackets at the entry. The expenses for this session were as follows:—

Classes and Subjects	£16	16	0
Lodgings	9	11	6
Books and Papers	1	0	0
Sundries	4	12	6
	<u>£32</u>	<u>0</u>	<u>0</u>

The Summer Session of 1851 was occupied with classes in botany and natural history, though he had practical anatomy and operative surgery as well. He obtained a whole superior extremity for 5s. and this seems to have been all he dissected. The "Classes and subjects" cost £13, 5s., and the total expenditure for the session was £24.

The Winter Session of 1851-52 was a busy one, which anatomy, chemistry, surgery, practice of physic, and hospital attendance must have filled well. The class fees amounted to £34, 16s. 6d., including £4, 4s. for "first examination for M.D." and the total expenditure for the session reached £50. The following Summer Session saw medical jurisprudence, midwifery, and "eyes" as his classes. Fees came to £7, 9s., and the total expenses to £16.

Though this student worked hard and his expenses were small, he gives evidence of healthy enjoyment, both physical and mental. Regularly, as Saturday came round, some part

Letter from Vienna

of the day was devoted to excursion in the neighbouring district. He does not appear to have gone to the same place twice. Burntisland, Cramond, Newhaven, Roslin, Zoological Gardens, the Pentlands and elsewhere were visited at an outlay of 1s. to 5s. per "jaunt." He was a member of the "Hunterian Society" whose subscription was 5s. and whose supper cost him an additional 2s., and he occasionally went to the theatre where his ticket cost him 2s., so we may take it he did not frequent the dress circle. It is obvious he measured his pleasures to his purse, not *vice versa*.

There is no necessity to moralise. The writer of the account book was a good student who gained honours and medals in many of his classes. Hard-working, life-absorbed in his profession, he was a good type. His business habits and his professional ability stood him in good stead through an honourable life, and making a point of always seeing ways and means clearly, as every student should, he reached the highest pinnacle a provincial general-practitioner may attain.

LETTER FROM VIENNA.

(From our own Correspondent.)

IN German Austria, quite recently, circumstances have arisen which have a very important bearing on the well-being of the medical fraternity there, and are also of interest to the profession generally.

The Austrian State has up to the present displayed very little consideration for doctors. By way of example, the fact may be cited that until a short time ago certain Imperial decrees of the time of the Empress Maria Theresa (1740-1780) remained binding on doctors, and that the barber of a gaol received a better salary for cutting the hair of the inmates, than did the prison doctor who examined and attended them. In many of his activities, indeed, the doctor was made to feel his inferiority, sometimes socially, sometimes financially, sometimes in both ways. Added thereto there came, along with modern health legislation, such as the Insurance Acts, in which the interests of the medical profession are deeply involved, not merely a total disregard of the wishes of doctors, but a neglect even to inquire what their wishes or views might be. A crisis was reached when the National Assembly, without any previous consultation with the profession, passed a law bestowing on dental mechanics—that is to say, lay persons—the privileges and powers of doctors. At this, the patience of the medical

Letter from Vienna

men came to an end, and they resolved to take measures to defend themselves. They formed an association (hitherto there had been no union among them) consisting of local branches subordinated to a central organisation (*Reichsverband*). The membership of the association comprises nearly all the doctors in the country. In Vienna, of more than 3000 medical men only from 30 to 40 stand aloof. Meetings of protest against the legislation above mentioned were called throughout the country for the 31st May. The Vienna meeting was the most important of these; it was attended by practically all the members, by the teaching staff of the university, and by the students. The great *Musikverein Saal* was filled to overflowing and could not accommodate all those who desired to attend. On the same day, by way of supporting the demonstration, a "strike" took place from eleven to four o'clock, all ordinary medical work being suspended and assistance given only in emergency.

At the meeting a resolution embodying the following points was carried by acclamation: The medical profession protests unanimously and decidedly against the attitude of the Government, of the executive, and of the legislature. It demands:—

1. A fundamental departure from the procedure hitherto adopted whereby legislation involving public health questions and the social-political status of medical men has been introduced without any consultation with the profession.
2. Immediate repeal by Parliament of the law concerning the regulation of doctors (*Aerzteordnung*).
3. Prompt reform of the Insurance Acts.
4. Creation of a Ministry of Health containing an assured majority of selected medical men.
5. Autonomy of the Public Health Authorities (*Volksgesundheits amts*).
6. A new Public Health Statute framed on modern lines.
7. Old age and sickness insurance for doctors in connection with the reform of the Insurance Acts.
8. Exemption of doctors from the profits tax (*Erwerbssteuer*).
9. Prompt reform of medical education and of post-graduate instruction.

These demands were presented to the Government as an ultimatum with a time limit. In the event of a satisfactory reply not being received by 30th June, it was intended to "strike" on 1st July. It happened that a few days after the meeting the ministry fell, and the new Government did not take office until nearly the end of June, so that the reply was not received until the time limit had almost expired. When received it was of a conciliatory nature, though not complying with all the requests. Some of the demands (1, 4, 5, and 9) were

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accepted without demur; others (2, 3, 6, 7) were held up as requiring further consideration; as regards (8) a very material remission of the tax was promised. This reply was deemed by the President of the Medical Association as sufficiently reassuring to postpone the threatened strike, arrangements for which, however, were proceeded with in case the explanations of Ministers should prove empty promises. Since then, representatives of the medical profession have been placed on various committees and commissions; it is hoped that the desired agreement may be arrived at, and that no such calamity as a medical strike may befall the people. Moreover, through the united and energetic action of the doctors, those in authority have at last learned that account must be taken of the medical profession, and that it cannot be treated *de haut en bas*, as heretofore. The public, with the exception of a few rabid Social Democrats, are wholly on the side of the profession, and indeed are grateful to them in so far as the drastic measure of striking was only to be employed in the last extremity, thus contrasting with the strikes by other callings, which have often been enforced in the most arbitrary and wanton manner.

OBITUARY

GEORGE HUNTER, M.D., F.R.C.P.E., F.R.C.S.E.

(AN APPRECIATION).

THE decade 1860-70 was remarkable for the large number of able young men who came to attend the Medical School of Edinburgh. Many of these gave early promise of distinction which was amply verified in their subsequent promotion to University chairs, lectureships, hospital or other public appointments at home or abroad. Others, of equally high promise, by choice or force of circumstances, betook themselves to the less ambitious but not less important sphere of general practice, into which they carried their gifts and attainments to the great advantage of the public, and to the credit of the schools that had trained them. To this latter class belonged Dr George Hunter, the announcement of whose death in Edinburgh on 20th September, in his eightieth year, the profession in Scotland has received with deep regret. George Hunter was born at Newfield, Caerlaverock, Dumfriesshire, in August 1842. He was the youngest son of a prosperous and highly respected farmer, whose ancestors during many genera-

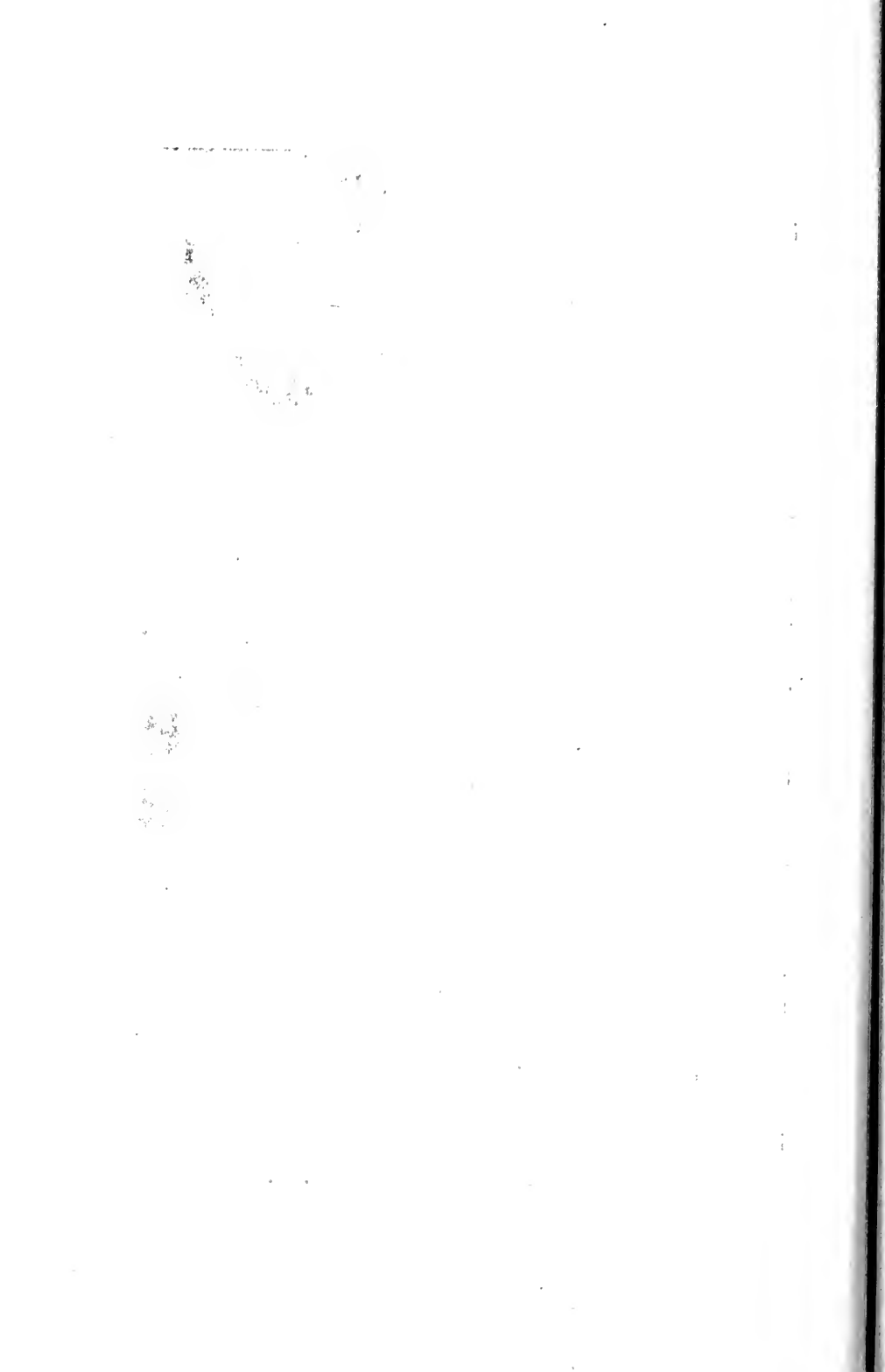
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tions had farmed the same land. Educated at Hutton Hall Academy, a well-known school in the south of Scotland, Hunter displayed proficiency as a pupil in all departments, so that when he entered the University of Edinburgh as a medical student he was able to pass all the preliminary examinations with distinction. Throughout his medical career at College he was known as one of the hardest-working and most successful students, figuring in almost all class prize lists, and in many carrying off the coveted medal. When the time for graduation came (1867) it was no surprise to his friends and fellow-students that he took his medical degree with high honours. After graduation his thoughts turned towards the Indian Medical Service into which several of his compeers had entered, but considerations of health forbade this, and while, doubtless, he would have achieved success in this sphere, a different career awaited him. Dr Warburton Begbie, whose prizeman Hunter had been, and who entertained the highest opinion of his abilities, was asked by Dr Baird of Linlithgow to find him a good man to be his assistant, and he had no hesitation in recommending his pupil. This was the turning-point in Hunter's career, and a fortunate one it proved to be. The relations of principal and assistant were ever of the happiest, and they seemed professionally made for each other—the senior personifying the knowledge, experience, and clinical judgment, combined with the dignity characteristic of the highest type of country doctor, and the junior the ardour, activity, high training, and scientific spirit of the young and enthusiastic graduate. They worked with complete harmony, giving of their best to the community in which their sphere of duty lay. The poor received the benefit of their attention and skill equally with the rich.

On Dr Baird's retirement the practice, which had extended widely in the district, was continued by Dr Hunter alone, and his professional life became still more strenuous as his reputation spread. He soon felt the necessity for assistance in his work, and he was fortunate in generally securing young graduates of more than average ability to whom service under such a master was felt by them to be training of the very kind to equip them for the duties and responsibilities of their future professional lives. The exacting demands of such a practice began to tell upon Dr Hunter's health, and in 1890 he moved from Linlithgow (where his nephew succeeded him) to Edin-



GEORGE HUNTER, M.D., F.R.C.P.E., F.R.C.S.E.



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burgh. Here he soon acquired an excellent practice, and at the same time entered eagerly into the medical life and interests of the Metropolis. It was characteristic of his zeal for gaining knowledge that he attended practical classes, the better to keep abreast of the progress and advance of medical science since his student days. A Fellow both of the Royal Colleges of Physicians and Surgeons, Dr Hunter filled the office of Examiner for their diploma. He held for a time the presidency of the Scottish Microscopical Society, to the transactions of which he made important contributions, particularly on the development and histology of the liver. His regular attendance at the meetings of the medical societies of the city bore testimony to the student-spirit so conspicuous throughout his whole career. Outside the domain of medicine Dr Hunter was extensively read in natural science, and his wide culture and refined taste were evident to all who came in contact with him.

During the active period of his life, when opportunity offered, he engaged in the usual sports of a country gentleman, but everything of this kind was always subordinate to the calls of duty, for he was devoted to his profession which he loved to the end of his life.

Of singularly gentle and courteous bearing, Dr Hunter gained and retained the affectionate confidence and esteem alike of his patients and of his professional brethren.

During the Great War, and after he had retired from active practice, Dr Hunter, though over 70 years of age, rendered notable service on recruiting and pension boards, engaging in the work with great zest, but, unfortunately, to the injury of his health; for these efforts proved to be beyond his strength, and, indeed, were in great measure the cause of the illness to which he succumbed. This illness he bore with Christian patience and fortitude, and it is pleasing to recall that in the months of waning strength he found solace from the things that are not seen but are eternal.

In this imperfect tribute the writer—his friend for more than half a century—feels how difficult it is to do anything like justice to his many excellences both professional and personal. One thing at least may be said with truth. So long as the University of Edinburgh can send forth medical graduates of the stamp of George Hunter she will not suffer in her renown.

J. O. A.

NEW BOOKS

Orthopedic Surgery of Injuries. Edited by Sir ROBERT JONES, K.B.E., C.B., F.R.C.S. 2 vols. Pp. 1232, with 474 illustrations. London: Henry Frowde and Hodder & Stoughton. 1921.

The appalling number of soldiers crippled by war injuries has given a great impetus to the study of the science and art of restoring function to deformed and disabled limbs and has led to marked advance in this branch of orthopædic surgery. The knowledge gained as a result of war experience is now most admirably recorded in the two volumes published under the editorship of Sir Robert Jones.

No less than 34 contributors take part, and all speak with authority on the subjects with which they deal. A foreword is written by Sir Thomas Goodwin and an introductory chapter on the Principles and Practice of H. O. Thomas by Sir Arthur Keith. Though a high standard is maintained throughout, special mention may be made of those chapters dealing with ununited fractures, malunion of the femur, orthopædic surgery of the hand and wrist, the knee joint, flail joints, and the operative treatment of war injuries of the peripheral nerves.

As a treatise on the orthopædic surgery of injuries, this work is comprehensive and moreover is thoroughly practical and abundantly illustrated. Not only does it furnish the orthopædic and general surgeon with a fund of useful information, but is a valuable contribution to the literature on war surgery.

Psycho-analysis and the War Neuroses. By Drs S. FERENCZI (Budapest), KARL ABRAHAM (Berlin), ERNST SIMMEL (Berlin), and ERNEST JONES (London). Introduction by Prof. SIGM. FREUD (Vienna). Pp. 59. London, Vienna, and New York: The International Psycho-analytical Press. 1921. Price 7s. 6d. net.

This slim volume gives a general summing-up by prominent psychotherapists of the Central Powers as to the position they have reached regarding shell-shock and allied conditions. Apparently their observations coincide in all essentials with those of our own doctors who dealt with such cases, although, as psycho-analysts, they of course put a special construction upon the phenomena. As they say, the essentially psychogenic nature of shell-shock and related neuroses has now been placed beyond dispute. Repression is seen to play an outstanding rôle. These conditions show Fear in various forms and degrees. The writers surrender sexuality as an exciting cause, but would fain still cling to it as a predisposing element at least. In any

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case they appeal to us to "suspend our judgment" in this matter, though why we should do so, three years after the war, they do not say. Men who had not been fully alive before the war were doubtless more prone to shell-shock—but Life is a greater thing than the sexual appetite. We do not observe that the work-cure enters into the psycho-analyst's scheme of therapy; yet, surely, *ergophobia* is one of the most urgent symptoms in these cases. In both matter and style this book is a characteristic product of Modern Freudism, and it is particularly valuable as being in small compass.

The Principles and Practice of Surgery. By HERMAN A. HAUBOLD. Pp. 2482, with 633 illustrations. London: D. Appleton & Co. 1921. 2 vols. 84s. net.

In these two volumes Dr Haubold has set out to give an account of the whole field of general and regional surgery, including operations and diseases of women. He has been confronted in this attempt with the usual difficulty—namely, the choice of subject-matter. It cannot be said that the selection of material here has been entirely happy, if the work is to be of the greatest value to students and practitioners. Thus we find as many as 30 pages devoted to the description of operations on bones—including an account of Albee's complicated apparatus—and the most detailed descriptions of operations such as gastrectomy, excision of the rectum and the like, while subjects of real importance to the practitioner, like whitlow and empyema, are dismissed in a few pages.

The lessons of the war have scarcely received the consideration which they merit. In the section on fractured femurs we find little or no mention of those methods of treatment whose value has been so fully demonstrated in civil as well as in military practice.

There is a copious bibliography derived chiefly from German sources.

The Pathology of the Pneumonia in the United States Army Camps during the Winter 1917-18. By W. G. MACCALLUM. Pp. 147, with 53 plates. *The Johns Hopkins Hospital Reports*, vol. xx., fasc. i. Baltimore: Johns Hopkins Press. 1920.

Pathological Anatomy of Pneumonia associated with Influenza. By W. G. MACCALLUM. Pp. 100, with 24 plates. *Johns Hopkins Hospital Reports*, vol. xx., fasc. ii. Baltimore: Johns Hopkins Press. 1921.

The first of these reports is a study of the pathology of the epidemic of pulmonary inflammations occurring in the United States Army Camps following epidemics of measles. MacCallum divides the pulmonary lesions into two main types apart from the cases of frank

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lobar pneumonia—(1) what he terms interstitial broncho-pneumonia, and (2) lobular pneumonia. The predominant organism isolated from these cases was a hæmolytic streptococcus, and he concludes that measles brings about a very marked predisposition to infection with this organism, although he believes that the streptococcus can invade, and even cause, great epidemics, without its aid. In addition he emphasises the fact that the combination of streptococcus infection with measles seems to produce a far more intense infection than the streptococcus alone, but he could not recognise any anatomical changes that were due to measles itself.

The cases of lobar pneumonia were caused by several types of pneumococcus, and he regarded these cases as being the ordinary types of pneumonia met with apart from the epidemic. Influenza bacilli were found in a minority of the epidemic cases, and he regards that bacillus as being, like the hæmolytic streptococcus, a purely secondary infection, measles in the majority of cases being the primary. A large number of cases are described in detail, and there are 53 excellent full-page plates illustrating the conditions described.

The second volume is a study of similar pulmonary inflammation met with during the epidemic of influenza of the autumn of 1918. In these cases a greater variety of organisms was met with, generally influenza bacilli, streptococci, and pneumococci of different types. A fact of the greatest importance is that when the epidemic was studied by the same observers using the same methods but in different camps, the influenza bacillus was found in almost every case in one camp, and in practically none in another.

He therefore concludes that invasion by the influenza bacillus is essentially a secondary phenomenon, just as is invasion by streptococci and pneumococci. He believes that epidemic influenza is a disease produced by some infective agent which differs from any one of those which we have definitely recognised in that we cannot see it, nor stain it, nor grow it, nor infect animals with it. He draws attention to the general resemblance which it bears to the infective agents which must be present in such exanthematic diseases as measles, scarlet fever, smallpox, etc.

In his description of the pulmonary lesions he is able to distinguish different types of reaction to different organisms, including a special variety of lesion due to the influenza bacillus. In a large number of cases a mixture of organisms present resulted in a mixture of different types of lesion. The chief point of the two papers is that in both epidemics all the bacteria observed were secondary infections, following in the first epidemic upon the invisible virus of measles, and in the second upon the invisible virus of influenza. The second volume like the first is well illustrated.

NOTES ON BOOKS

The Heart: Old and New Views, by H. L. Flint (H. K. Lewis & Co., price 15s. net), is an attempt to present a consecutive account of the growth of cardiological science from ancient to modern times. At the outset the author traces the beliefs of ancient days of Egypt, Greece, and Italy up to the great discovery by Harvey; thereafter his historical survey is more fragmentary. The clinical work of the nineteenth century is largely ignored, and likewise the influence of morbid anatomy, bacteriology, radiology, and modern chemistry upon our conception of cardiac disease. The second part of the book is concerned mainly with the use of the polygraph and with the methods of differentiating the varieties of cardiac irregularity from one another. A couple of pages on "the systolic murmur" and a page and a half on the principles of treatment bring the book to a close.

In *Tuberculosis in India*, Dr Arthur Lankester, M.D. (Butterworth & Co., price 10s.), states in the preface that he has tried to reach both lay and medical readers, his object being to point out the close relationship which exists between a disease like tuberculosis and social problems. The book is divided into three parts, viz., (a) prevalence, (b) causation, (c) prevention, as seen in India. Among many interesting chapters may be mentioned those dealing with glandular tuberculosis, the absence of bovine tubercle, the question of overcrowding and the social customs of women in relation to the disease.

When the first edition of the *Outlines of Zoology*, by Professor J. Arthur Thomson (Henry Frowde and Hodder & Stoughton, price 18s. net), appeared many years ago, it was soon recognised as a most trustworthy text-book on the subject. It is a compact but complete volume dealing systematically with the subject on broad general principles. The seventh edition has maintained the same high standard as its predecessors, and new material has been added. In the seventh edition "representative test questions" have been added. The volume can be recommended with confidence to students and others interested in the subject, both on account of the subject matter and the clear lucid manner in which it is presented. The type, quality of paper and binding are not up to the standard of some of the former editions.

Insanity and Mental Deficiency in Relation to Legal Responsibility, by William G. H. Cook, LL.D. (Lond.) (George Routledge & Sons, Ltd., price 10s. 6d. net), was the author's thesis for the Degree of Doctor of Laws in the University of London. It deals with the difficult question of insanity and mental deficiency in relation to civil legal responsibility. The question of criminal responsibility does not come within the scope of the work, which confines itself to the various

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aspects of responsibility in relation to contract, marriage, divorce, testamentary capacity, etc. The question of responsibility in these and other matters is gone into with great thoroughness and with a wealth of precedent and illustration. Summaries of the law on such subjects in the various countries of the world are also a feature of the book of considerable interest. It is written purely from a legal point of view, and the chapter on "definition and classification" in particular will hardly meet with the approval of many practical alienists, though it is the starting-point of the author, upon which much of the rest of the book depends. Such an able and clear exposition of the legal standpoint, however, cannot fail to be helpful to the physician, who may be called upon to give expert evidence in cases in which the question of responsibility arises, by showing him the development and foundation of the legal attitude to these matters.

Prosthetic Dentistry, by Douglas Gabell (Henry Frowde and Hodder & Stoughton, price 12s. 6d. net), deals only with the work done by the dentist, with the patient in the chair, during the production of plate dentures, and is much more limited in its scope than its title would imply. It is intended to guide students and young dentists in the proper performance of the various processes, and contains a great deal of useful instruction based on the author's experience as teacher and practitioner. A good index adds to the value of the book.

NOTES

AT the recent Examination of the Board of the Royal College of Physicians of Edinburgh, Royal College of Surgeons of Edinburgh, and Royal Faculty of Physicians and Surgeons of Glasgow, the following candidates having passed the requisite examinations, were admitted Diplomates in Public Health:—A. F. Adamson, M.B., Ch.B.; Isabella M. M. Aitken, M.B., Ch.B.; W. R. Clayton-Heslop, M.D., F.R.C.S.Edin.; E. M. E. Cumming, M.B., Ch.B.; William Cunningham, M.B., Ch.B.; Andrew Davidson, M.B., Ch.B.; A. M. Davidson, M.B., Ch.B.; Jean D. Don, M.B., Ch.B., M.D.; David Fyfe, M.D., F.R.C.S.Edin.; Janet Grant, M.B., Ch.B.; D. C. Lamont, M.B., Ch.B.; Isabel Macfie, M.B., Ch.B.; William M'Kendrick, M.B., Ch.B.; Jane S. M'Phail, M.B., Ch.B.; George Morris, M.B., Ch.B.; T. D. Murison, L.R.C.P. & S.E. &c.; E. W. Richards, M.B., Ch.B.; Helena J. Robertson, M.B., Ch.B.; Richard Sandilands, M.B., Ch.B.; John W. Simpson, M.B., Ch.B.; A. D. Stewart, M.B., C.M., F.R.C.S.Edin.; Mary C. Walker, M.B., Ch.B.

ANALYTICAL NOTES

DUTCH ADVOCAT (BEVAN'S, 146 FENCHURCH ST., LONDON).

WE have received from Messrs Bevan a sample of their cordial, Advocaat. For the benefit of the uninitiated it may be explained that Advocaat is a mixture of the finest brandy and yolk of egg, with certain flavouring agents—in fact, a super-egg-flip. Bevan's Advocaat is a very seductive and palatable cordial, and ought to be better known than it is, as its composition renders it of undoubted use in conditions of exhaustion, and in convalescence. It is specially prepared for the English market, as ordinary Dutch Advocaat is too thick to suit the British palate.

VACCINEURIN (SUMNER & Co. LTD., Liverpool).

Vaccineurin is stated by the makers (the Sarss Serum and Vaccine Institute, Berne) to consist of a mixture of the vaccines of several bacterio-autolytic organisms, and to have given relief in intractable forms of neuritis, such as sciatica and facial neuralgia. It is issued in three series, in graded strengths, and a "course" consists of eighteen doses at intervals of two days.

BOOKS RECEIVED

- BALME, HAROLD. China and Modern Medicine
(United Council for Missionary Education) Cloth, 5s.; paper, 3s. 6d.
- BEATTIE, J. MARTIN, and W. E. CARNEGIE DICKSON. A Text-book of
Special Pathology. Second Edition
(Wm. Heinemann (Medical Books), Ltd.) 31s. 6d.
- BINNIE, JOHN FAIRBAIRN. Manual of Operative Surgery. Eighth Edition
(H. K. Lewis & Co., Ltd.) £3, 3s.
- BROWNE, A. R. I. Medical Electricity for Students
(Oxford Medical Publications) 12s. 6d.
- BRUCE, J. MITCHELL, and WALTER J. DILLING. Materia Medica and
Therapeutics. Twelfth Edition (Cassell & Co., Ltd.) 10s. 6d.
- BURNS, DAVID, and D. NOEL PATON. An Introduction to Biophysics
(J. & A. Churchill) 21s.
- CROWTHER, J. A. A Manual of Physics. Second Edition
(Oxford Medical Publications) 16s.
- CUSHMAN, ALLERTON S. Chemistry and Civilisation
(E. & S. Livingstone) 15s.
- DAS, KEDARNATH. A Text-book of Midwifery for Medical Schools and
Colleges in India (Calcutta: Thacker, Spink & Co.) Rs. 13-8
- ERNST, F. G. Orthopædic Apparatus (The Whitefriars Press, Ltd.) 12s. 6d.
- FAIRBAIRN, JOHN S. Encyclopædia of Midwifery and the Diseases of
Women (Oxford Medical Publications) £3, 3s.
- FEHLINGER, H. Sexual Life of Primitive People (A. & C. Black, Ltd.) 6s.
- FITZWILLIAMS, DUNCAN C. L. A Pocket Surgery (Edward Arnold) 10s. 6d.
- FOWLER, Sir JAMES KINGSTON. Pulmonary Tuberculosis
(Macmillan & Co., Ltd.) 20s.

Books Received

FRITCH, F. E., and E. J. SALISBURY. Botany for Students of Medicine and Pharmacy	(G. Bell & Sons, Ltd.)	10s. 6d.
GHOSH, BIRENDRA NATH, and JAHAR LAL DAS. A Treatise on Hygiene and Public Health. Fourth Edition	(Hilton & Co.)	9s. 6d.
HARRISON, L. W. Diagnosis and Treatment of Venereal Diseases in General Practice. Third Edition	(Oxford Medical Publications)	25s.
HERBERT, ARTHUR STANLEY. The Hot Springs of New Zealand	(H. K. Lewis & Co., Ltd.)	15s.
HOLT, L. EMMETT. The Care and Feeding of Children. Ninth Edition	(D. Appleton & Co.)	4s.
KEEN'S SURGERY. Supplementary, Vols. VII. and VIII., with complete Index	(W. B. Saunders Co.) Cloth, £6, 6s. ; half morocco, £7, 15s.	
KERR, J. GRAHAM. Zoology for Medical Students	(Macmillan & Co., Ltd.)	25s.
LISTER, THOMAS D. Medical Examination for Life Insurance	(Edward Arnold)	10s. 6d.
MACKENZIE, Sir JAMES. Heart Disease and Pregnancy	(Oxford Medical Publications)	8s. 6d.
METCHNIKOFF, OLGA. The Life of Elie Metchnikoff	(Constable & Co.)	21s.
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ON THE CLINICAL ASPECTS OF AIR-SWALLOWING AND SOME OTHER "BAD HABITS" IN INFANTS AND YOUNG CHILDREN.*

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ALMOST all the functional nervous disorders of infancy fall readily into one or other of three groups: (1) Reflex Neuroses; (2) Co-ordination Neuroses; and (3) Somato-psychoses or "Bad Habits":—

(1) The **reflex neuroses** include a variety of motor and sensory disturbances—some trivial and some very serious—which affect various parts and functions of the body. Among them are such ailments as colic, nervous diarrhoea and vomiting, spasmodic dysuria, rectal and vesical spasm and retention, pollakiuria, excessive sneezing, asthma, polypnoea, laryngismus, tetany, convulsions, and many others. Of all of these it may be said that they are due either to a heightened sensitiveness of the nervous system, which leads to an exaggeration of the ordinary reflex reactions, or to abnormally strong peripheral sources of reflex irritation. The symptoms produced may be either local or general in character, and may be set up by chemical alterations in the tissues due to infective processes or other changes, or by irritation of a mechanical nature.

Their treatment, generally speaking, consists first in soothing the nervous system by sedatives and other means, and secondly in searching for and removing the local causes of excessive irritation.

(2) The **co-ordination neuroses** are due to morbid derangements which depend on the co-ordination of a more or less

* Notes of a Lecture delivered to the Staff of the Manchester Babies' Hospital in April 1921.

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complicated nervous and muscular mechanism. They include such disorders as those which Sir James Paget called "stammering with other organs than those of speech." Examples of these are—difficulty in swallowing solids, spasmodic stricture of the œsophagus, pyloric spasm, some cases of fæcal and urinary incontinence and retention, congenital laryngeal stridor, stammering, strabismus, conjugate nystagmus, spasmus nutans with convergent nystagmus and hippus, and so on. They tend to set in mainly at a time of life when the co-ordinated action involved has not been practised very long, so that it is not as yet being carried out with as much confidence and precision as it will be later.* It seems as if a temporary exhaustion of the nervous mechanism concerned has taken place, similar to that which occurs in writer's cramp.

The minor neurosis, which is called "spasmus nutans" or "head-nodding," is probably the most typical example of this group. It sets in between the fourth and twelfth months of life, at an age when a large share of the infant's energies is taken up with learning the new and difficult arts of raising the head, holding it steady, and turning it round to look at things. At the same time, the baby is practising convergence of his eyes on an object, and the focussing of his accommodation. Therefore, in addition to the nodding and shaking of the head, there is often a peculiar form of convergent nystagmus, and occasionally also an alternate contraction and dilatation of the pupil (hippus).

The usual management of the co-ordination neuroses consists mainly in securing bodily and mental rest, and in careful and patient attention to the general health and hygiene.

(3) The **somato-psychoses** or "**bad habits**" differ in many respects from the members of the other two groups. They seem to be due to a perversion of certain of the normal instincts of infancy, and to represent morbid exaggerations of trivial actions which occur naturally in most or in all children. Their practice, doubtless, contributes in a small way, as the exercise of all normal functions does, to the child's general feeling of well-being; but they occasion no special gratification. Their

* It has been suggested that certain congenital abnormalities of hollow viscera—congenital hypertrophy of the pylorus and stomach-wall, megalo-colon, and congenital hypertrophy of the bladder with hydronephrosis—are probably due to a similar process of inco-ordination beginning before birth (*British Med. Journ.*, 1902, ii., 678).

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morbid counterparts, however, are a distinct source of pleasure, and have a strong fascination for those who practise them. The main somato-psychoses are pica, thumb-sucking, tongue-sucking, air-swallowing, rumination, biting the nails and hands, masturbation, head-rolling, head-banging, voluntary head-nodding and head-shaking, and rocking movements of the body. The various manifestations of the kind of self-assertive naughtiness which is sometimes spoken of as "negativism," which leads to obstinate refusal to take food, to have the bowels moved at the proper time, and to go to sleep, have many features in common with the somato-psychoses.

The reflex and co-ordination neuroses have it in common that they are always involuntary, and that their occurrence is never a cause of pleasure to the patient; while the most striking and essential characteristic of the somato-psychoses is their deliberate and voluntary, although often subconscious, nature. Although he may not realise it, and his parents very generally do not, the child practises them mainly because he likes doing so, and he always shows signs of annoyance when their continuance is interfered with.

The management of these minor psychoses differs entirely from that of the involuntary neuroses. While the treatment of the latter consists largely in bodily and mental rest, that of the former is mainly psychical and includes forms of mental stimulation and encouragement to bodily exertion—inducing the baby to practise self-control, to use his energy in higher and better ways, and to take an interest in other more rational actions and amusements.

The particular members of the group which I propose to consider now are air-swallowing, rumination, pica, and tongue-sucking. They are all met with often in young babies, and are connected, more or less, with the processes of sucking and swallowing. They seem to me to require more attention than they usually receive from medical men, for they are very apt to be overlooked altogether unless they are inquired about; and the failure to recognise them leads often to inaccurate diagnosis and ineffectual treatment. The different habits usually occur separately, but more than one of them may be present in the same patient. Sometimes they are met along with or following symptoms of a different origin—for example, air-gulping, rumination, or pica may start during an attack of indigestion; but they tend to persist indefinitely

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if not recognised and treated, although the digestion may for long have been quite normal.

Air-swallowing (Aerophagia).

The subject of air-swallowing as a clinical symptom was studied by Magendie¹ as long ago as 1815, and a great deal has been written about it in France since his time. In recent years, for example, Mathieu² and his pupils—Mauban³ and others—have published many papers on it. Much interesting work bearing on the subject has also been done in German-speaking countries. In America, Cannon⁴ and Kantor⁵ have recently investigated its phenomena by modern methods, and the latter has given an excellent and comprehensive account of the literature. Of the papers on air-swallowing which have appeared in this country, the most interesting is that by the late Professor John Wyllie.⁶ Owing perhaps to its vague title, and to the place where it appeared, this very able article seems to have escaped the notice of most subsequent writers—even those of the author's own school—and I am glad to have this opportunity of drawing attention to it.

The process of taking air into the stomach may be either physiological or pathological.

Physiological Air-swallowing.

Under normal conditions, percussion and X-ray examination always reveal the presence of air in the upper part of the stomach as well as in the bowel, and there can be no doubt that a moderate amount of air is a normal content of these viscera, and has a useful and necessary function there. It has been shown by von Mikulicz⁷ that the thoracic portion of the œsophagus—between the level of the larynx and the cardia—also normally contains air; and Cannon has made observations which seem to show that the gas present in the stomach and bowel has an important action in keeping up their muscular tone.

There can be little doubt that the great bulk of the gas normally present in the stomach comes there by being swallowed. None of the natural processes which take place in the organ are capable of producing gas in any quantity; and when the gas is removed and analysed, it is found to contain nothing but the ordinary constituents of atmospheric air, though these may

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be present in somewhat altered proportions. The source of the larger quantity of CO_2 usually found in it need not be considered here.

There are three ways in which atmospheric air may be taken into the stomach:—

(1) *Air-swallowing proper*.—In adults and older children, the movements which take place in the mouth during deglutition cause a free admixture of air-bubbles with the food, saliva, and pharyngeal mucus, and a considerable amount of gas may be introduced into the stomach in this way. In infants, however, it is probable that this form of air-swallowing occurs to a very small extent, if at all, because they have so much less saliva than older children and the movements of the tongue in them are so much less free.

(2) *Air-gulping*.—Under normal conditions, a certain amount of air is gulped down into the stomach during swallowing between mouthfuls of food and drink. This process takes place freely in babies. We are all familiar with the way careful mothers have of interrupting the infant's meal by placing him upright, and patting his back to help him to bring up again some of the wind he has taken down in this way. If something of the sort is not done, so much air may accumulate in the child's stomach as to lead to vomiting.

(3) *Air-sucking*.—This method differs from the other two in that it is not simply an act of swallowing, but depends, to begin with, on a *vis a fronte* exerted by respiratory movements. It is very doubtful whether air-sucking is ever practised voluntarily or instinctively in babies. It has been shown, however, that in them air may be drawn into the stomach unintentionally during such spasmodic respiratory efforts as hiccough, sobbing and laughing, and during severe paroxysms of coughing.

Fate of the Air swallowed.—The natural sequence to the distension of the stomach with air in any way is the eructation of most of it, since only a small amount is required for physiological purposes. To enable this to take place freely in the case of a baby, it is usually necessary, as we have already seen, that the child should be held upright occasionally, as he is unable to raise himself. In the case of older children, sitting up or running about is, in most cases, rapidly followed by the required eructation. The air which is not returned in this way gradually finds its way through the pylorus, and much of it is in time passed from the bowel.

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Pathological Air-swallowing.

In adults and older children, abnormal aerophagia occurs frequently as a symptom of various forms of dyspepsia; and it is especially characteristic of neurasthenic and hysterical patients. Occasionally it is associated with the allied habit of rumination.

The air may be introduced into the stomach in any of the ways already mentioned:—

(1) *Air-swallowing proper*.—Although there is no reason to believe that this ever occurs as a habit in young babies, it occasionally develops to an excessive degree in adults and older children from their having got into the way of swallowing large quantities of air-containing saliva, in order to lessen the discomfort arising from undue acidity of the stomach contents.

(2) *Air-gulping*.—The abnormal form of air-gulping is not very uncommon at any age. In infants it is often associated with, and assisted by, the habit of sucking the fingers, a “comforter,” or some other object. When it is present as a “bad habit,” it has probably begun during some functional derangement of the digestion owing to its affording a degree of relief to the uncomfortable sensations arising from the condition of the stomach; but the habit, when once formed, tends to last long after the indigestion has ceased. In older children, as in neurotic adults, noisy eructations sometimes take place; these excite the interest of the patient's friends, which leads to his attention being increasingly concentrated on the habit and to its assuming an exaggerated form.

Wyllie drew attention to the fact that a morbid habit of air-gulping is quite common and well known in cattle. In calves it results from the animals sucking one another's ears. When this is practised habitually, it is said to cause an amount of gastric distension that interferes with nutrition. In adult cattle a dangerous form of air-gulping occasionally occurs as the result of a large piece of turnip or potato having become impacted in the œsophagus. In the animal's attempt to get this obstruction down, he swallows large quantities of air. This passes the obstruction and distends the rumen so rapidly that it may burst within an hour or two, unless relief is afforded. In many agricultural districts this emergency is met by administering a lubricating oil, and endeavouring to push the obstruction down by means of a probang; and, in urgent cases, the

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stomach is punctured through the abdominal wall, with a trocar. In East Lothian a more interesting, and apparently more efficacious, form of treatment is used. This consists in placing between the animal's back teeth, a bit, made of a piece of wood a foot long and two inches thick, and fixing it in position by tying its ends to the horns. The presence of the bit renders swallowing movements impossible for the time, so that the distension of the rumen ceases to increase; and it gradually subsides as the air finds its way into the bowel. This treatment is said to be always successful; and a similar proceeding—the insertion of a cork between the molar teeth—was shown by Wyllie to be equally efficacious when the habit is met with in human beings.

The symptoms of abnormal air-gulping in babies are often overlooked, owing largely to its being only practised when the child is left alone and no one is paying him any attention. In older children its occurrence is more easily recognised, being more noticeable from a distance. The child, if sitting, bends slightly forward; or, if lying, raises himself. He then shuts his mouth firmly, lowers his chin, assumes an air of absorption, and settles himself to swallow. As the air goes down, a slight clucking sound may be heard when it passes into the air-containing thoracic portion of the œsophagus. Then the mouth is usually opened and the wind comes up.

In the child, as in the cow, the process of air-gulping cannot go on if the mouth is kept open; and this, as we have seen, gives an important indication for treatment. The ease and freedom of the process also depends largely on the amount of saliva present, as swallowing becomes difficult when the passages are dry. When the patient is left undisturbed, the air-gulping goes on until he is tired, or until his supply of saliva is exhausted. While the air is being swallowed, the up-and-down movements of the larynx are easily seen; and on inspection and percussion of the abdomen, the stomach is found to be rapidly distending.

In some cases, especially in hysterical patients, the air is quickly returned before it has passed beyond the œsophagus. In others it passes right down into the stomach. When this occurs, most of it is usually brought up again shortly, provided there is nothing to prevent the child sitting up; but, if he has to remain lying on his back or right side, the necessary eructations do not take place and the air gradually passes

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through the pylorus; and, later, such of it as is not absorbed in the bowel is expelled from the anus.

In those cases in which the gastric flatus is readily regurgitated, little inconvenience results from the habit; but when, for any reason, the wind is retained, unpleasant and sometimes serious results may follow. In many infants the passage of the wind through the bowel may cause severe recurrent colic, along with restlessness and disturbed sleep. In a few instances the distension of the stomach, if extreme in degree and not soon relieved, may have grave consequences. It occasionally happens that weakly babies who are too young or too frail to sit up, and who have been left lying in their cots while their mothers were out or otherwise engaged, are found to have died suddenly; and, on post-mortem examination, nothing is found except extreme distension of the stomach and some collapse of the base of the left lung. Wyllie regarded it as probable that some at least of these cases were due to air-gulping, and I have seen several post-mortems which seemed to confirm his opinion.

In very rare instances in older children, the patient is quite unable to return the wind from the stomach, even when he is running about (see Case III.). This may be due to some slight anatomical peculiarity in the region of the cardiac orifice. It is probable, however, that it depends more, and perhaps altogether, on the special vigour and rapidity with which the stomach has been distended in these cases; it has been found that when the stomach is very quickly distended in adults by the use of effervescing powders, eructation is often impossible for some time after. Rapid and vigorous distension of the stomach from air-gulping gives rise to pain in the epigastrium, followed sometimes by severe cardiac and respiratory distress owing to pressure on the neighbouring parts; and, if its cause is not recognised, may occasion considerable anxiety.

Treatment.—In order to break the habit of air-gulping in infants, the mother or nurse must be on the lookout for the beginning of the swallowing movements; and, when any indication of them is noticed, must at once take measures to divert the baby's attention to other things. It is when he is feeling dull that he practises such habits, never when he is looking at things or being spoken to. If the child has the habit of sucking his fingers or any other object this must be stopped. Lastly, so long as the air-gulping continues, free eructation of

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the wind should be encouraged by giving a carminative from time to time, and by setting the child up and patting his back.

In older children, it is important, to begin with, that the mother should explain to the patient that all the trouble is due merely to a bad habit which must be given up. If this, as is quite likely, is not sufficient, the next thing is to arrange for the insertion of a cork between the molar teeth whenever the first signs of air-gulping are noticed. This is a very effective measure. It not only stops the swallowing of air entirely for the time, but also helps greatly to discourage its recurrence because it constitutes an annoying interruption to what the child has hitherto felt to be, at least in its earlier stages, a soothing and restful habit.

Illustrative Cases of Air-gulping.:—CASE I.—Last year I was asked by a friend to see a baby girl of six weeks on account of constant screaming which had begun during the first week or two of life, while the baby was on the breast, and had continued ever since. The patient was a small and nervous, but otherwise healthy-looking infant, the only child of healthy parents. During the first three weeks she had vomited about twice daily, immediately after nursing. When three weeks old she was weaned, and since then there had been no more vomiting. She had always been encouraged to use a "comforter." The baby suffered from constantly recurring, severe abdominal pain, and often brought up wind by the mouth, as well as passing much by the bowel. She was nervous and sleepless and not gaining weight.

As the symptoms were regarded as probably due to the swallowing of air which was not being freely regurgitated, the nurse was ordered to stop the use of the "comforter," to place the child in the upright position regularly after each bottle, and to encourage the return of the swallowed air by giving a carminative mixture. This treatment was at once entirely successful; the pains ceased and a normal gain in weight took place. There has been no recurrence of the symptoms.

CASE II.—Several years ago I saw, with a surgical colleague, a rather hysterical girl of about ten years who was being kept lying in a Phelps' box on account of severe spinal caries. She had recurrent abdominal pains and other signs of indigestion, and her stomach was enormously distended with wind from habitual air-gulping. We found it necessary, therefore, in spite of the spinal condition, to have her propped up in a sitting position several times a day, besides giving her a carminative. Under this treatment, large quantities of wind were brought up, and she made a satisfactory recovery.

CASE III.—About a year ago I was asked to examine a healthy-looking, high-spirited and very impulsive little girl of five years, on

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account of regularly recurring attacks of severe abdominal pain, accompanied by cyanosis, respiratory distress, and collapse. She had been nursed by her mother for five months, and had always been perfectly healthy apart from the attacks for which I saw her and mild whooping-cough at seven months. She had evidently been carefully and judiciously fed and looked after.

The first attack of pain was said to have occurred at four months and did not seem to have been very bad. The second took place at about fourteen months. In it the pain was severe and recurred eight or nine times in the day. After this, similar attacks had continued to occur at varying intervals until she was three and a half years old. Since then there had been a regular recurrence at intervals of four to eight weeks (usually every six weeks). The attacks were said to last generally for two or three days. On the first, there might only be one or two spasms of the pain, but on the succeeding days they were much more numerous—usually ten or twelve. For about ten days after the attacks, the child was often nervous and restless and slept badly. The symptoms were always much the same. She would suddenly say to her mother or nurse, "I've got a pain," and ask to have a hand pressed to her chest. Her mother said that on these occasions the heart was always felt to be "going like a sledge-hammer." The pain was in the middle line of the epigastrium, and evidently originated in the stomach. It had been noticed that from the beginning of the paroxysm the child continued to make vigorous swallowing movements and that the stomach region became greatly distended. No eructations of wind had been observed, but intestinal flatus was passed later. During the height of the attack the child was cyanosed, exhausted, gasping, and in great distress, but did not lose consciousness. After this condition had lasted for a few minutes she would say, "I'm better now," and usually would return actively to her play; sometimes, however, she would lie and sleep for a time. Rarely—only on two or three occasions—vomiting had occurred, and it always brought the symptoms to an end at once.

Two months before I saw the child, she had been X-rayed by a first-rate radiographer. From his report it appeared that before an attack the stomach was normal in size and mobility, and that there was no evidence of any organic disease, past or present, in the abdomen. In another plate, however, which was taken during an attack, there was found "a most remarkable upward displacement of the left diaphragm," by the over-distended stomach. There was also said to be positive evidence of greatly delayed passage of food from the stomach.

The child was brought from the country into a nursing home in Edinburgh on the first day of an attack, in order that her symptoms

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might be studied. As might have been expected, however, from the nature of the attack, the interest of the journey and her various new experiences in the nursing home had so strong a mental effect on the patient that the attack of air-gulping was cut short. I was, therefore, unable to watch the details of the seizure; but the mother's clear descriptions were sufficient for the diagnosis. There could be no doubt that the symptoms were caused by the rapid distention of the stomach by very vigorous air-gulping and an inability to bring the wind up. The pain was accounted for by the stretching of the stomach-wall and the circulatory and respiratory embarrassment by the consequent displacement of the heart and diaphragm.

The nature of the attack was explained to the child's mother, and she was advised, whenever a tendency to swallow air was noticed, to place a cork between the child's molar teeth. At first, the patient entered intelligently into the question of her treatment; and, when she felt an inclination to swallow, would ask for the cork and try to put it in place herself. Later, the desire to swallow air returned strongly; and, as it has, unfortunately, been found impossible to take sufficiently stringent measures to prevent its occurrence altogether, milder attacks of gastric distention have continued to recur from time to time. These, however, seem to cause little inconvenience. There has been no severe attack since the beginning of the treatment.

(3) *Air-sucking*.—This third way of getting air into the stomach is not very uncommon in adults, and it sometimes occurs in older children.

It was pointed out by Magendie that the common habit of "crib-biting" in horses is allied to air-swallowing in human beings. This is a form of air-sucking. When a horse is going to practise it, he begins by seizing the crib with his teeth, arching his neck, and strongly contracting the neck-muscles. By means of this muscular action the atmospheric pressure is taken off the œsophagus so that its internal pressure becomes negative and the air rushes into it. This is probably followed by an effort of inspiration with the glottis closed; and the wind which has been drawn into the œsophagus is sucked down into the stomach. The habit in horses is highly infectious by imitation, and it lowers the health and value of the animals that practise it.

In human beings the process is somewhat different. In them there is nothing corresponding to the crib-biting, but a similar forcible contraction of the neck muscles occurs, accompanied by strong inspirations with the glottis closed, which produce a negative pressure in the thoracic portion of

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the œsophagus. In man, the air may be taken into the stomach, as usually happens in the horse, but it is more often returned immediately from the gullet in the form of loud eructations.

Unlike air-gulping, air-sucking can sometimes be continued with the mouth wide open, so that Wyllie was able to watch the details of an attack with the laryngoscope. The treatment by the insertion of a cork between the teeth is therefore not always successful in this as it is in the former habit.

Rumination (Merycism) in Babies.

Much has been written on the practice of rumination in adults,⁸ but the attention of the profession has only recently been directed to its practical importance as a habit in babies, and to the serious results it may have in them.

As in the case of air-swallowing, the habit, or something like it, often occurs as a physiological act in normal infants. This we see mostly in strong, vigorous children who regularly take more milk from the breast or bottle than they require, and relieve themselves by regurgitating the surplus immediately after. The process, which is sometimes called "possetting," has long been well known, and it has been recognised that exaggerated forms of it must not be mistaken for chronic vomiting. It is not usually a matter of any importance.

The *pathological* variety of the habit may develop at any age in connection with indigestion; but the most typical cases are those which begin in young babies without any obvious predisposing cause. It is one of the most characteristic somato-psychoses of the early months of life. In some cases the habit is slight in degree, only lasts a short time, and does little harm; but in others it is severe and persistent and has a serious effect on the child's nutrition. The babies who develop it are generally of a noticeably neurotic type.

The symptoms are easily recognised when looked for. Shortly after a meal has been taken, the child assumes an air of abstraction, holds his head somewhat back, and makes chewing movements with his jaws—the mouth being wide open. A quantity of milk then wells up into the back of the throat. After gurgling there for a varying time, it may, if not large in amount, be swallowed again; but usually so much is brought up at a time that most of it runs out of the

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mouth and is lost. Consequently, though the child's appetite and digestion are normal, he becomes emaciated from lack of food. Before, and during, the regurgitation of the milk, the infants often show obvious signs of gratification, and many assist the process by putting the fingers in the mouth. In most of the cases there are no symptoms of dyspepsia, and whatever food is retained is well digested. When the habit is given up, the weight goes up normally at once; but so long as it continues, the child remains thin, nervous, and restless.

The first important thing in the *treatment* of the condition is that the mother and nurse should be made to understand clearly that the whole trouble arises from what is merely a "bad habit," and that, if this is stopped, all will go well. The next point is that they must bring home to the infant—as they are usually able to do in a surprisingly short time—that the bringing up of the milk is a thing which incurs their displeasure and must not be continued.

It is a good thing if the baby can be induced to go to sleep after each meal; and, in the early stages of the treatment, the administration of small doses of bromide may sometimes be useful in helping him to do so. So long as he remains wakeful, he must be watched and not left alone to practise his habit. On the slightest indication of its beginning, he should be talked to and interested in some way or other.

Children who are old enough to sit up generally do so before beginning to regurgitate the milk. Under these circumstances, the child should be kept lying flat for some time after each meal; and, if he assists the return of the milk by putting his fingers into his mouth, this must of course be prevented—either by the use of elbow splints or in some other way.

If close and intelligent personal attention by the mother or nurse can be secured, the habit can usually be stopped in a short time. In three recent cases, in infants of four, five, and six months respectively, the habit, which was said to have begun shortly after birth, had practically ceased, and a satisfactory gain in weight set in, within two or three weeks of the beginning of such treatment.

In those unfortunate babies whose mothers have not the time, or will not take the trouble necessary, to wean them from the habit, it is likely to persist for many months, and the danger of serious and sometimes fatal debility and emaciation is

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considerable. Dr Grulee⁹ has found that a large proportion of these cases die.

Tongue-sucking.

Tongue-sucking is a trivial and not very uncommon habit in normal babies, and it is very common in certain types of the mentally defective. In normal infants it often does not last long, but in imbeciles, especially in mongols, it is apt to be practised constantly and very vigorously for long periods; in many of them it is associated with protrusion of the tongue. In such long-continued cases, the habit leads, within a few months, to great enlargement of the papillæ, and later—after some years—to deep fissuring of the tongue. So far as I know, it has no serious effect on the child's health. Constant protrusion of the tongue, with or without tongue-sucking, in new-born babies, is a symptom which should never be ignored. I have known several instances, both in cretins and mongols, in which this was the only abnormality which the parents had noticed in early infancy.

Some devoted and tactful mothers are able in time to train even mongol babies to cease sucking their tongues; but, in the great majority of cases, the habit resists such slight attempts as are made to check it, and persists into later childhood.

Pica.

In young babies pica often takes the form of eating the mud they pick off their father's boots or from the wheels of their own perambulators. Older infants who are able to crawl may eat fragments of plaster from broken places on the wall, or ashes from the grate.

The youngest child I have seen with this habit was a girl baby of thirteen weeks whom I was asked to examine on account of loss of weight and constantly recurring attacks of screaming—apparently due to colic. She had been on the breast only since birth, and the question was whether she should be weaned on account of the screaming attacks. For the first four weeks of life, the motions had been normal and regular; later there was some constipation with much intestinal flatulence and mucus in the stools. The child was a very friendly and intelligent baby and looked healthy, apart from her emaciation. She weighed two ounces less than at birth.

Clinical Aspects of Air-Swallowing

It was found that she always wore a fluffy woollen shawl and that she constantly sucked it. From time to time little balls of wool had been noticed in her motions, and these had been very numerous of late. When the shawl was removed, the screaming attacks entirely ceased and the child gained weight normally, and did well with no other treatment. Apparently, the colic had either been caused by the wool she swallowed or perhaps by the amount of air she took in along with it.

The treatment of such cases consists simply in removing the abnormal things for which the child has a craving, and in attending to the general health.

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PHYSICAL EDUCATION IN THE UNIVERSITIES OF THE U.S.A.*

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I CONSIDER it a great privilege and pleasure to appear before this Society in this old City of Edinburgh. I feel as if I were coming home, because, amongst my earliest recollections is seeing in my father's study at the Manse the cards admitting him to the classes in Divinity in Edinburgh University. I also come from a University which owes a great deal to Edinburgh. Dr John Morgan, about 1740, came to Edinburgh, took his medical course and returned to Philadelphia, his native city, founding the Medical School of the University of Pennsylvania on the lines of your Medical School in Edinburgh, and we of the Faculty have tried as well as we can to live up to the traditions he brought over at that time. We also owe another of our early Pennsylvanians to Edinburgh. The first Provost of the University, William Smith, was an Edinburgh man. He showed the characteristic conservatism, mingled with enterprise that we associate with Edinburgh, because, when he became involved in the controversy which led to the Revolution, he was a Tory, and, like the man whose mother pointed him out marching past in the regiment, he was the only one in step. As a result, he was put in prison, and, while in prison, he carried on his classes, his students coming to him in the gaol, and in his spare time he wooed and won the gaoler's daughter and married her. Then we were brought up on the great tradition of the Edinburgh School of Anatomists, and I remember very well that in 1904, when I had to make a decision as to whether I should go on with anatomy, because at that time I was Lecturer on Anatomy at MacGill, or whether I should go into Physical Education and accept a very flattering offer, the great anatomical succession which had dominated Edinburgh was very much in my mind, having been drilled into us by my chief, Dr Francis J. Shepherd. It seemed to me that the great minds that had reaped so thoroughly the field of anatomy left nothing further for us but a few gleanings, while this field of physical education was before us with practically no workers, or very few, and it was for

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that reason that I accepted the Chair which was then founded in the University of Pennsylvania, the Chair of Physical Education, a new Chair, the occupant of which was to give training in Physio-Therapy, Hydro-Therapy and Electro-Therapy, to the medical student, and also to give a course of lectures to the graduate students in Public Health, the application of Exercise to Municipal Playgrounds, School Systems, and other such questions. Among my most important duties was to be the physical examination of all incoming students as part of their entrance to the University, the design of courses of exercise for them, the general supervision of their health, and, to a certain extent, the regulation of their athletic activities. Since that time there has been a remarkable change in the attitude of the educational world toward this subject, especially in America and Canada. The American Universities differ a good deal from the Universities of the old land in that there are three distinct types. You have, first of all, the State University, endowed by the State, which forms, as it were, the culmination of the State Educational system; Institutions which constantly send Commissions or individuals on missions to discover what are the best or at least the latest developments in the educational world. They can introduce new ideas and new courses without the necessity of upsetting long-standing traditions, or of disturbing what might be called "vested interests." Then you have the Colleges founded by a group or an individual—a sort of proprietary Institution as we might call them—supported wholly by voluntary contributions, their policy frequently dictated by those who support them. One of those Colleges elected a new President who thought that the elective system of study had been carried too far, and that more subjects should be made compulsory for the Degree. He was met at a meeting of the Board of Trustees by violent opposition, one of its members remarking with horror, "Why, you are trying to turn the dear old place into an Educational Institution!" Those Institutions have their place in the Educational system, but there is a third class also to which the University of Pennsylvania belongs. The University of Pennsylvania was founded by Benjamin Franklin and a group of his friends as a private Institution, and has gradually expanded, until it is supported partly by the State and partly by private donations. It began with a College Department only, but it now represents a cluster of Faculties,

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the College or Academic Faculty being one only, with various Scientific Schools, Engineering, Finance, Fine Arts, Law, Medicine and Dentistry being included in the body. In all, we have now about 11,000 students, and the supervision of such a large body of men, not more than one-fifth of whom are in residence, is the problem that confronts the Director of Physical Education. Since the Department was founded, about 90 per cent. of those Institutions that are represented on the Carnegie Foundation have adopted some form of physical education as part of their regular College curriculum. In almost all these cases, the education is directed by a physician who is a member of the Faculty, and physical education ranks on an absolute equality with the other work—that is to say, students get credited with the same credit and are subject to the same penalties that are attached to any other subject. It is quite possible for a student to have his Degree withheld because he has not fulfilled his requirements in physical education.

I will describe the way in which the work is started with an incoming student.

When he registers at the Bursar's office, he receives a card which tells him to report at the office of the gymnasium. He reports with this card and there receives an appointment for his physical examination. On this card he is told to report at such and such an hour, undressed and bathed, and he is supplied with a blank which he is to fill up in the meantime, containing a series of questions somewhat like an insurance blank, except that the questions are chosen with an entirely different object. This blank first asks his name and age, then his national origin, because in the United States there are very few native born of the second or third generation, and the answer may give us valuable information; then follow two questions, one of which asks what manual labour, if any, or what work or occupation he has had before coming to College. We find that a great many students have earned the money that brings them to College by the sweat of their brow, and that is an important thing to find out. The next question asks what sports or games he has engaged in. Now, the object of these two questions is to find out whether he has led an outdoor or an indoor life, whether he has been accustomed to hard physical work or whether he has been a school boy, whether he has been active athletically or whether he has been sedentary. The form then goes on to ask what illnesses have kept him in bed for two weeks or more,

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and another question asks if he has any remaining effects from any previous illness, accident, or operation. At first we asked them if they had ever been ill and they usually said "No," but a student is much more apt to remember if he has been confined to bed by illness. This gives us a very good idea of whether there is anything requiring special attention in the examination which is about to be made. The form then goes on to ask questions about the respiratory system and about the circulatory system, the digestive system and the genito-urinary system. We thus get answers that enable the examiner to take up with the student any special difficulty which he may have had, to be on the lookout for an unsound abdominal wall after an operation for appendicitis, or for tuberculosis, or for a history of rheumatism in the examination of the heart. The student then goes into the examining room. On the floor of the examining room there are two foot-prints painted on a certain spot on which the student is told to stand. He is directly in front of a mirror and the examiner stands behind him, slightly to one side, so that he can look at his back and profile, and by looking in the mirror can see his full face. Another mirror is so arranged that the student can see his own back, without moving, and defects of posture can be pointed out without changing his position. The examiner now dictates his examination to a clerk. First, the general posture—and we lay great stress on the way he carries himself—we record if the chest is carried well forward or if it is sunken and his abdomen protruding, if there is an unevenness of the shoulders or if there is any lateral deviation of the spine. His posture would be marked "Good," "Fair," or "Poor." His shoulders would be marked "Right low" or "Left low." If there is scoliosis, it is noted. When still in the same position, his legs are marked as being "Straight" or "Bowed," or "Knock-kneed" and his feet "Flat" or "Normal," or any deformity is noted. The state of his nutrition is noted, the amount of subcutaneous fat, the condition of his muscles and of his veins. He is then told to lie down on a padded table on his back, and while he takes that position the examiner goes over to the desk and makes out any prescriptions that may be necessary as a result of the examination of his posture. If he has a drooping right shoulder he gets what we call a "Right low" card—a card with a series of exercises designed to raise that shoulder. If his feet are flat he gets a "Flat foot" card. The clerk makes out these cards

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and lays them on the desk beside him to explain to the student at the end of the examination. We then go over the heart, auscultate the heart and the apices of the lungs. If there is no history of tuberculosis and nothing to point to anything suspicious in the respiratory or cardiac regions, we go no further, but if there is any history of pleurisy or suspicion of tuberculosis the examination is made much more completely. If there is anything to lead to suspicion of cardiac weakness, the examination of the heart is continued by taking the blood-pressure and the pulse after exercise, the exercise consisting of fifty steps of stationary running, which gets the heart pumping pretty well. We also note the speed with which the heart returns to its normal rate. After this, he is given one test for his hearing. A tuning-fork with 200 vibrations giving a medium tone is used as a standard. He is then given a test of distant vision, with glasses if he wears glasses, because our attempt is not to make a very close diagnosis but merely to tell whether he has efficient vision with the correction if necessary; if he does not come up to the normal, he is then given an appointment with the specialist at his office. His nose, throat, and teeth are examined in the same way. A great many of these men require a further examination. They are given an appointment at the specialist's office, and they go at an arranged hour and have this careful examination made, but we make our routine examination as simple as possible, because the great majority of the men do not require any further examination, and it would only take up time and make the work cumbrous without producing a sufficient return for the extra amount of work. These examinations begin about the 1st October. They last from about 11 in the morning till 1, and from 2.30 in the afternoon till 6, and we have five examiners working in relays of two at a time. In that way we are enabled to get about 2000 examinations during the month of October. Whenever a difficult case comes up, one that requires consultation or requires further examination, he is passed on to me by one of the examiners with a note, and I then devote the necessary amount of time to go thoroughly into this particular case. Although at first I made all the examinations myself, I soon found that, with increasing numbers, it was impossible to cover the ground. Frequently we find cases which show the necessity for this examination. Last year a young man came who was apparently normal but on examina-

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tion we found a very badly dilated heart. We found that he rapidly became breathless, and that he had all the signs of a close approach to failure in compensation. After going over him carefully and confirming this, I wrote to his father and to his doctor and had him taken out of the very arduous course that his father had laid out for him and given a very much lighter course and, I believe, saved him from a very early collapse. We have a very considerable number of cases, perhaps ten or fifteen each year, that come in with the unmistakable first signs of tuberculosis of the lungs. Sometimes these men are sent home, but more frequently they are kept under observation, given special feeding and special treatment. For that purpose we have two or three College physicians, and we have as a consulting staff the entire Faculty when the case is obscure and requires very special attention. Now, this is not the only work that goes on in the Department during the month of October, because, as these prescription cards for corrective exercises are given, the student reports on the gymnasium floor to the instructor, who groups them in small classes of half a dozen and takes them over their corrective exercises three times a week during this month. At the same time there are two lectures a week on personal hygiene given to the entire class. These lectures cover subjects like diet, clothing, a few of the simpler ideas about the carrying of disease, questions of diet, the seriousness of venereal diseases as a menace to health, and subjects of that kind. At the same time, the men who are engaged in football and rowing all pass their medical examination, and receive cards which are given to the manager of rowing or football, and enable him to enrol himself as a member of the football squad or on one of the crews. At the end of October we have covered the entire incoming class, and those men who are likely to be injured by engaging in heavy sport like football, and we are then ready to begin the educational part of the course. Any course of exercise for the College student must keep in mind two things, first, the correction of the abnormal physical life that a student must lead. He is, in many cases, spending long hours in the laboratory, the architectural student is bending over the draughting board while daylight lasts, the chemical engineer is breathing the fumes of chlorine and other gases, so that the exercises given should always keep in mind the correction of a sedentary life, and should include setting-up exercises for the expansion of the chest, and the development of

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the muscles of the waist, because these are the muscles most neglected. Very few men neglect the muscles of the legs, because they have a good deal of walking to do, but they do neglect the muscles of the trunk and of the arms. The second principle that is kept in mind is, that any course of exercise must be really an educational course, that is, men must be taught to be physically intelligent. I know that the term "physical education" is used very loosely, but there is such a thing as physical intelligence, and it is that physical intelligence that has raised mankind above the brute, and has raised the more civilised races above those that are uncivilised; it is that kind of physical intelligence which has survived in all our games: the great fundamental co-ordinations, those co-ordinations which govern locomotion—running and jumping; locomotion in the water—swimming—climbing, and those feats which everyone ought to be able to do, and would have an opportunity of doing if we did not live surrounded by so many conventions as we do. Then there are those other great co-ordinations which have to do with fighting, wrestling, striking with the fist, the extension of the fist by means of the fencing foil, the sabre or the single-stick. The still further extension of the range by means of missiles, throwing or catching of balls, and nearly all our games have to do with throwing or catching of balls, whether it is "fives," tennis, a cricket ball or a baseball, a basket ball or a football, and these have always been and can best be taught in some form of game, and frequently the game has to be designed so that it will enable a large number of men to play at the same time. There are very few places that can accommodate a thousand men all playing cricket or baseball or football at once, so that for these men who cannot have the opportunity you must design games which will give them the same kind of education in throwing, in catching, in dodging, and in jumping, that they would get in these natural games if they were able to practise them in the form in which they have survived up to the present time. There is a still further phase of the question that must not be lost sight of, and that is the idea of co-operation. We know that the boy who has learned to sacrifice his individual glory for the glory of the team has arrived at about the same stage of civilisation as the savages in a tribe which has consented to combine with another tribe under one leader in order to defeat a third. Games are important because they are the only way, or one of the few ways, in which

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this form of community life can be taught to the boy or to the young man. A great many students—the great majority of them in fact—can never become great athletes, or even good ones. It is surprising what a large proportion of them don't want to become great athletes, but it is surprising also how much a student can learn of an athletic exercise without becoming an athlete. It is not everyone who can swim the Channel, and very few want to try, but anyone of ordinary intelligence can learn to take care of himself in the water, he can learn to dive, he can learn to stay under water, he can learn to rescue a person who is drowning, he can learn what might be called versatility, he may become well educated in swimming without becoming a great athlete. It seems to me that the great athlete is very closely allied to the great genius in almost anything else. We cannot account for the great powers of a man in any particular athletic exercise by the tape-line alone; nothing can account for that fine mental and physical judgment that goes to make a champion except the theory that I have just stated. In every student community we find a few who are natural athletes and take naturally to competitive sports and games. It is just as important that they should be given an opportunity of practising these games, and that they should practise them under the best conditions, as it is that a simpler form of physical education should be given to the men who are never likely to become good or efficient in any game. There are certain conditions, however, in inter-Collegiate competitive athletics which are very prominently before us in America, and which I do not think are so prominent with you here. In the first place, there is a tremendous interest in athletic competitions. In an inter-Collegiate football game between Pennsylvania and Cornell we have usually from 30,000 to 40,000 people present. In the Harvard-Yale football game there will be probably as many as 70,000 people drawn together to witness that annual contest. These spectators will pay anything from one to five dollars a-piece to see this game. It becomes a sort of Derby and Ascot combined. It is the one thing to which they look forward all year. All the débutants are there, all the friends of the players, all the men who have graduated from either College since its foundation or who know friends who have, and the struggle for tickets is often very great. This has led to abuses in the handling of the money involved, and it has led of course to extravagances which are, to say the least, unhealthy, and that means that the University

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has sooner or later to take more or less control of the accounting for these large sums of money, and of redistributing them, so that a game like football will pay for those games and exercises which are not remunerative, like rowing, which is a costly sport and brings in no revenue, and for the conduct of the less spectacular exercises and classes. We find then the curious condition of football financing most of the other competitive sports in a number of Colleges. The great rivalry between the Colleges has led to other abuses, and we have had to insist upon a certain grade of scholarship among students before they will be permitted to represent the University in athletic contests. It used to be the case that a student who was very much wanted in a football team—it has not entirely disappeared either—would feel himself a sort of privileged individual, and he did not feel that the ordinary laws of the College applied to him. It is told of one who was wanted very much in the team that he was down in his scholarship, and a sympathetic examiner had to examine him on chemistry and gave him two questions. He asked, "How do you make chlorine?" and the student gave an answer which was wrong. He then asked, "How do you make sulphuric acid?" and the student's answer was, "I don't know," and the examiner said, "That is right; I believe that you don't know. That will be 50 per cent, so you get a pass."

We also must insist upon a residence rule. In the United States there is an individual who is known as a tramp athlete; he is the successor to the peripatetic philosopher. He used to go to one College and play football for the year and then disappear, he went to another College the next year and played football for that year, and then he disappeared from that College, and then he appeared at a third, and that went on indefinitely, so we now require a man to be in residence and pass the examinations for one year before he can represent the University in any inter-Collegiate competition, and that has put a great damper on that sort of wanderer.

Whenever we apply physical training to a large student body it is necessary to have a very wide range of election; it is not possible to give the same kind of exercise to every man. We find, of course, in the examination, after sorting-out the different grades, that out of four thousand men examined there will be perhaps three hundred or four hundred who should be under some form of supervision—prescription work. It may be a man with a dilated heart, who should do perhaps nothing more than

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play golf, or walk ; he should be advised not to take part in any more strenuous forms of competition, and prevented if necessary. It may be a man who is quite unambitious athletically. He has a heavy course, he does not feel he can spare the time and he does not want to spare the time. His exercise must be taken in as concentrated a form as possible ; he must give the least amount of time and yet get his credit for having taken the exercise ; you have also to provide for the men who want to take all their exercise in athletic games, so that we have a very wide range of election given. A student may play football in the Fall, in the Winter he may play basket ball, and in the Spring he may run on the track, or in the Fall he may be in the harriers or the cross-country team, in the Winter he may take the gymnastic classes, and in the Spring he may play base-ball, a game which is not very well known here, but in every case he must take a minimum amount of exercise under the direction of the Department and for that purpose we have extended the form of exercise as much as possible. We have riding, polo, cricket, golf—in all about twenty different forms of games or sports that men can take—and they are given, as I say, a very wide range. The only thing that is required is that it must be taken under the direction of the Department, and that involves keeping account of their attendance and recording it so that they may receive credit. The returns of attendance are given in just as the returns in any other class.

One of the most difficult problems is that of grading men in some way that would be comparable to the grading of academic work. It is quite possible to do this. In football a man who makes the 'Varsity team would rank as a first-class Honours man—the man who makes a class team may be ranked second-class ; and a man who does not get into either of the teams but plays throughout the season would be given a pass. When it comes to the gymnastic classes, we start by a series of what we call arrangements. The first arrangement is preceded by an examination in some simple form of exercise, like jumping over a bar or string two feet high, for agility, the pulling up by the arms over a horizontal bar, and perhaps rolling over on a mat—three simple movements. It is surprising and shocking to see how few men are able to do a simple test like that. The tests are made so that about 50 per cent. of them will fail, and on that examination they are graded into first or second grade. They are then given a series of ten

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lessons on that particular kind of activity, climbing or vaulting, and then they are examined again and we find that 90 per cent. will pass the examination and only 10 per cent. fail. In that way we are able to grade the men on the work that they do on the gymnasium floor. There is no reason why exercise on the gymnasium floor should not be almost as attractive as the work out of doors. The climate makes it necessary, and if we had not the gymnasium it would be impossible to do anything at certain seasons. We usually arrange the gymnastic exercises in the form of games in which some definite thing is taught. One of the favourite games is "dodge ball," in which the men are taught to be agile and light on their feet. A circle is formed and another group stands inside this circle and the basket ball is thrown backward and forward by the men in the circle trying to strike the men in the centre. This game makes a man alert and accustomed to dodge and to be agile. There are very few of us who cannot remember an occasion when that ability to dodge has prevented accidents. They say that the introduction of the motor car has divided the world into two classes, the "quick" and the "dead," and there is a good deal of truth in that. If you analyse the number of Colles's fractures you get and see how many of those are due to clumsiness, to the inability to keep your balance or to save yourself when you fall, you would be surprised at the high proportion that are preventable. Physical intelligence obtained by physical education has a very real value, it matters not how artificial our civilisation may be, and will never lose its value; it will always be one of the best assets that we can have. In the last arrangement of the gymnasium work for the year we analyse one of the well-known forms of physical exercise, like boxing, or wrestling or fencing, in the form of a class drill; the men are divided into couples and they are given their leads and guards at boxing, and they go through them; they are given the various holds and grips in wrestling, they are taught how to "bridge." Our purpose is not only to give them some knowledge of these arts, but also to introduce them, very often for the first time, to the sensation of striking and guarding and the feel of a "half-Nelson" lock about the neck. It is surprising how many men become interested and join the boxing club or the fencing club, and take it up as a sport. Many of them when they graduate find themselves good boxers, or fencers, or wrestlers. We do not encourage men to

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remain in the classes more than one, or at most two years, because we feel it shows a lack of progress if they do, but we do encourage them to take an interest in one or more of these different sports. It is interesting to notice how the men are distributed in these different forms of sport. If you take our last census taken in 1913, out of the 4000 men that were taking the course at that time we found that 1338 were in some form of competitive athletics, that is to say, they reported for one of the teams and started, but almost half of them dropped back and went into the gymnastic classes before the season was over. As soon as a man stops football practice he has to come back to gymnastic classes. There were 1283 who chose the gymnastic classes and about 400 who took the prescription work, that is to say, they were taking corrective exercises, and reporting from time to time to the doctor. It will be seen then that about half of the students chose the gymnastic classes in preference to the athletics. I am sure that in Edinburgh there is a large number of men who are not wealthy, who are wanting to save as much time as they can, who are keenly interested in their course and who want to get as much value from their course as they can—they would not be Scots if they didn't—and who feel they can afford very little time, but if they can in the course of an hour leave the class-room, get half an hour's brisk exercise, get a shower bath and rub down and dress and be back in to another class within the hour, they feel that the time was well spent. We have five classes each day, two from 10 to 12, and three in the afternoon from 3 to 6. The exercise begins with running, a short setting-up drill, then a gymnastic game, and another of these exercises which have been set up to bring about those co-ordinations that I have spoken about.

We feel that the University has a very great responsibility for the student who comes to us. We feel that we have the control of the last growing years of his life. He practically stops growing at 25. Eighteen to 23 are the last years in which you can get any appreciable results. Of course all physical education should begin with the child and any logical course must be continuous and progressive throughout the whole growing period, but there is this golden age from 18 to 23 which is under the control of the University, and we feel that we would be remiss in our duty to the students if we did not take every precaution lest they come to grief, and in addition to that, if we did not use every

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opportunity to give them a sound physical education adapted to their age, as well as a mental education. It is impossible to separate them, they are inseparable parts of a complete whole, and it seems to me that in Britain at this time when a great swath has been cut through the youth of the country, we need to consider very carefully how those who are coming up to take the vacant places may be made efficient, so that they will carry on the work of the Empire in the difficult years to come.

DISCUSSION.

Sir Leslie Mackenzie.—It became clear to us about seventeen years ago in Scotland that if you are to make the most of the intellectual capacities of the young, you have got to superintend the physical basis practically from the time of conception till the end of adolescence—a very large order. The Physical Training Commission (Scotland) sat seventeen years ago as the result of the revelations of the Boer War. These revelations have been more than confirmed by the revelations of the National Service Report, Sir James Galloway's Committee, where nearly three millions of men have been reported upon. It is there stated that out of nine adult men fairly representative, not perhaps of the very best parts of the community that went to the war but of perfectly typical industrial communities, only three can be set down as physically fit and healthy, the test being capacity to serve in the field; two are slightly less efficient; other two, if I remember rightly, were so far below the mark or standard to be attained that they were recorded as nearly physical wrecks, and the remainder, certainly one out of the nine, was regarded as almost a confirmed invalid. After the Boer War medical inspection of school children was established in Scotland. At this moment the Scottish Board of Health is responsible for the medical inspection of about eight hundred thousand Scottish children. In England the Ministry of Health is responsible for about six million children. Well, in the Reports by Sir George Newman for the ten years' medical inspection in England it was pointed out that there were something like two millions out of the six millions, certainly one million markedly, that did require some form of special medical treatment to make them reasonably fit. Professor M'Kenzie comes here as a Professor of Physical Education. The very word means a revolution in our attitude towards the whole system of athletics because in the old days the drill sergeant was the ideal of physical training and it was called "Physical Training." Physical training has its place, as we all know, but for all purposes at every stage of life physical education is the proper term and that means physical education adjusted to the physical conditions of every

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person whatsoever. The University here is not fulfilling its duty when it is presenting to its students only channels of intellectual attainment. If the same variety were applied in the provision of facilities for physical education in the University of Edinburgh, I personally am quite certain that the output of intellectual work would be at least no less. Of course that is always subject to the Scottish reservation that the primary purpose of life is not a physical purpose at all, but against that I set this, that physical education is itself a mental process. One of the great fallacies of the whole of our athletics and every kind of game which is run to excess is that it has been conceived simply as a physical materialistic process. It is not so. It is really the control of the growth of character in all its phases for every conceivable duty. In that sense, I do not think that any University can be other than right in setting itself conscientiously and under the guidance of men of experience like Professor Tait M'Kenzie to provide the facilities for discipline in physical education that physical education alone can give.

Dr Cruikshank.—Although a good deal of progress has been made since the Report Sir Leslie Mackenzie referred to was published, we have not yet by any means carried out the recommendations of that Commission. In our schools we are not giving the amount of time to physical education which that Commission recommended, but there is promise that within a measurable time we may have a greater proportion of the school time devoted to physical education. The system we are following in the Primary Schools now is based upon the Swedish system, using such exercises as do not require apparatus. In the Higher Grade and Elementary Schools we have apparatus with which it is possible to carry out the entire Swedish system. We have, however, introduced more of general activity exercises, such as games and dancing, interspersed throughout the lessons in order to quicken the actions of the children, make them brighter, more alert, and give them real pleasure in it. When I began to do this work, it was often carried out under very unsatisfactory conditions. The teachers had an entire misconception of the purpose of physical training and taught it in a most mechanical, uninteresting, and useless way. We are rapidly passing beyond that stage, and a physical training lesson as conducted in our Elementary Schools is bound to do good to the children not only physically but mentally. We are concerned first of all about the physical effect of the training, but we do not forget the important educational values that are attached to it. We are anxious to see that all the work is made interesting, and when we come up to the higher grades of schools, the Intermediate and Secondary Schools, we are finding our children doing what is really difficult work, in the sense of requiring good balance, good carriage, and so on. In addition to the type of exercise

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and the modification of the lesson which we have made recently, the Scottish Education Department has just issued a Circular dealing with the question of physical education in schools, the main purpose of that Memorandum being to try and destroy the old notion that physical education is synonymous with drill. When physical education was first introduced into the schools it was simply called "drill," and the work was done mostly by drill sergeants who knew practically nothing about physiology or growth, and the special exercises that were required for growing children. We want the thing to be looked at from a very much brighter and more comprehensive aspect than mere drill. We also want the view broadened beyond mere physical training, and to rope in a good deal of instruction in personal hygiene, the result being that the physical education includes everything that has to do with the physical well-being of the children. In our Scottish Schools we have not made very great headway in introducing the personal hygiene element into the work, but we hope that in the near future we will have a good deal of time given to that also. In our Training Colleges we make very special provision for the training of the teachers because the whole system depends on the training of these teachers. The majority of junior students have a two years' course of training, and the students in full training at the Training Colleges have at least two hours per week given up entirely to the study of physical education in addition to their Training as junior students. Practically every one of our Training Colleges has a whole time medical officer whose duty it is to instruct teachers in personal hygiene, and to supervise their physical education. There is in Scotland one important college, started by the Carnegie Trustees in Dunfermline. It is now a Central Institution, and is about to be taken over as a centre for the National Physical Education of Teachers. At this College about twenty expert teachers of physical training are turned out every year. The students enter for a two years' course of training, and the whole course is given up to the study of physical education and to its underlying principles. Physical education is taught in relation to science, and anatomy is taught in a thoroughly practical manner, which enables the students to understand the relationship of the subject to physical education; the same holds good of physiology and hygiene. Students there are taught to recognise all the ailments which children suffer from, and what to do when they recognise them. These experts are going to visit the Elementary Schools and to assist and advise the ordinary teacher in the application of physical education in those Elementary Schools. All this stops at the Training College; there is nothing corresponding to this work carried out in the Universities. It is a pity that this should be the case, because I am quite sure that in our Universities

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this question of physical education would be taken up by the great majority of students with enthusiasm if really first-rate men were put in charge of it. Everything depends on putting in charge the right man, and in Pennsylvania they are fortunate in getting so able a man as Dr Tait M'Kenzie to take charge of the physical education.

Sir Montagu Cotterill.—In our Public Schools the question of athletics has by no means been neglected, not only as a voluntary amusement for the boys, but much more than that, because at every well-conducted Public School games are not only entered into voluntarily by the boys, but every boy is made to join according to his supposed ability. A master is set aside who has a knowledge of, and an interest in sport, and he is responsible for making every boy in the school do a certain amount of athletic work, and in this way the boys at these schools are made to educate themselves and to get the advantages that accrue from an athletic life. We are indebted to Dr Tait M'Kenzie for the hints that he has given us, because after a boy leaves a Public School and goes to a University, those who have been in contact with athletics in the University know that too few of the students take any interest in the athletic side of University life. It is purely voluntary, no pressure is put upon them, and the result is that only those men who have a tendency and a liking for athletic pursuits go in for anything of the kind. I am glad to say that our University Authorities have recognised that it is their duty to help the Athletic Committees, and they now provide us with a certain amount of money and a certain amount of recognition, but I think both could be easily multiplied by ten to the great advantage of all concerned, and I hope that we shall follow in what is being done in Pennsylvania and elsewhere to make this recognition of the athletic side of University life a more prominent feature in this country.

Mr Cathcart.—Professor Tait M'Kenzie has done Edinburgh University and Scotland a great service in coming to tell us the work that has been done in this department in America. The explanation that has been given as to the working-class schools is a revelation to me, and one feels that if the kind of work which is being done for the Board Schools could be done for the Universities it would be of immense value to the State. Professor Tait M'Kenzie has shown what can be done to develop the physique of an enormous body of students—11,000. Now, while many of us would like to see the athletic sports taken part in by a very much larger porportion of the men than do so, if the physical development of the students were to depend upon our athletics as they are carried on in the fields, it would be impossible to expect them all to be physically developed;

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but Professor Tait M'Kenzie has shown us how the large bodies of men in a big University can get the necessary training in the development of their bodies as the result of training in co-ordination and training in balance, which are important for the after-life, and I do not think that we ought to rest until something equivalent is done, beginning perhaps in a small way, in Edinburgh University. I think that if people realised what was wanted, then the question would become a practical one before long, and it is only by our knowing what can be done, and what has been done, that we can get the thing started. Mr Cathcart asked about the accommodation provided in the athletic fields in the University of Pennsylvania.

Dr Flett emphasised the fact that athletics in the University here are utterly unorganised. Athletic sports and exercises are only practised by a limited number of men. In America only about 10 per cent. of the men will respond voluntarily to any invitation to take part in sports and athletic culture; in Edinburgh nothing like 10 per cent. of the students join the athletic clubs and take any part in the exercises. He asked Dr Tait M'Kenzie what the cost per man per annum is in Pennsylvania. That information might give us some idea of what the cost of introducing such a system into Edinburgh would be.

Dr George Mackay expressed his appreciation of the necessity for the introduction of physical education on such lines as have been laid down, to make it possible that the state of physical disability which has been quoted by Sir Leslie Mackenzie should be lessened in this country. The scheme which had been propounded must command our admiration. A commencing careful analysis of the physical fitness of the students should certainly be the basis of any attempted scheme for introducing physical education here. Those who have watched the development of athleticism have fully appreciated what mistakes can be made by men being allowed to indulge in forms of athletics for which they are physically unfit, and how necessary it is that the instruction should be carried on on proper scientific lines.

Professor Meakins said that he had had the honour of being instructed by Dr Tait M'Kenzie when he was a student in anatomy, and saw then his wonderful conception of physical education. One point among many which struck him forcibly was the examination of the students when they came to Pennsylvania University. They have there a population of practically 11,000 young adults. That is a fair-sized city. Before the student enters the University, it should be seen to that he is physically fit. We all realise how physical defects are probably the forerunners, or probably the fore-manifestors, of coming disease, and probably Professor M'Kenzie is carrying out among the

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rising population a piece of work which is beyond all computation, and that is the correction of developmental disorders, and, what is much more important, the prevention of possible future disease. In University life the keenest students are probably not those who pass their examinations best, but those who take part in athletic and physical sports. The short experience I have had of Edinburgh will bear out the impression I have obtained elsewhere, because I know from my own personal experience that the men I have been associated with as my students and students of other classes who take the keenest interest and expend the greatest energy and spend a lot of time apart from their studies in developing the athletic side of Edinburgh University, are also the best men, and sometimes the best women, in the student body. From an educational point of view, to train the man's body to be alert—he has a joy of living which he can only get from being in the heart of physical life—makes his mind alert, and the two go hand-in-hand. Professor Tait M'Kenzie has bemoaned the number who fall back. I would like to know the number of those who come to the University with no desire to take part in physical exercise or sports of any kind, and who are then initiated into this new world—how many of them go on. I am certain that probably there is an equal if not a larger number go on, and that among them are discovered a number of the best athletes.

Dr Sym.—The athletic associations connected with the University can only appeal to a small number. There are many students who are not very good at any form of sport and who have no interest whatever in these associations. They have no interest in playing a game with a man who can beat them with his left hand and his eyes shut. These things are very good for those who have an interest in them, but they are no use to 85 per cent. of the students at the University. That is where Professor M'Kenzie's scheme is enormously superior. Get a hold of everyone and apply to each person the kind of physical education that he is capable of being given and of attaining some degree of efficiency in. I hope to see what has been done in Pennsylvania done here, and the good which has been carried on in the schools here carried further still into the Universities.

Dr Chalmers Watson.—Professor Tait M'Kenzie touched the keynote of the position when he said that the University Authorities of Pennsylvania have a certain sense of responsibility in regard to the physical education as well as the intellectual attainments of the students, and all of us must regret that that feeling of responsibility is comparatively absent in this and in most other universities. I hope that his address will stimulate us to get what they have over there. He has dealt very largely with the prophylactic side of exercise. The

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basis of his address is that physical exercise and sound nutrition are the best training for resisting the minor ailments of this life. One is interested in the value of these remedial exercises in the relief and cure of disease. Is his association in any way connected with one or other of the leading hospitals, and do the hospitals make use of the departments that are provided in the University, and, more particularly, what proportion of the convalescent cases in any medical ward is transferred during their stay in hospital to get the benefit of their remedial exercises, these being one of the most potent remedial processes at our disposal? Just as we have been in the past in catering for the athletic side of our Universities, most if not all of our hospital authorities are sadly behind in recognising the beneficial result of physical exercise in the cure of disease.

The President (*Mr F. M. Caird*) made reference to certain points with which he had been struck during a recent visit to Germany.

It will be remembered that, prior to the Great War, conscription in that country had afforded a thorough physical training for every male, and, in addition, from about 1905 great attention had been bestowed upon open-air teaching, swimming, and athletics, more especially in the large towns during school terms. Since the war military life no longer dominates early manhood, and yet, although bread is relatively scarce, still rationed, and a general food economy obtains, not only does the general nutrition and physique maintain its old level, but the elasticity, carriage, and bearing of the young women command attention to an extent which was not formerly so obvious.

It would appear that the old military training was now being replaced by concentration upon physical education, and ample opportunities for this could be recognised in the extensive parks and open spaces devoted to this end. Everywhere one met with facilities for football, tennis, gymnastics, running, and athletics in general, and there were more people to be seen actively engaged in sports than serving as spectators. Moreover, while railway traffic is cut down and coal is expensive, the train and tramway service, which on Sundays carry the public to the suburbs, woods, and surrounding country, seemed to be rather increased than curtailed. One received the impression that the public well-being was carefully tended and that every encouragement was given to physical education in a manner which we in Great Britain might with advantage emulate, the Universities taking the lead.

Professor Tait M'Kenzie, in replying to the discussion, said: This discussion has been so rich that I feel I can only touch upon a few of the points which might well form the basis of a much longer discussion, and I may begin by saying that the

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same problem spoken of by Sir Leslie Mackenzie as arising after the Boer War struck the United States with overwhelming force after the publication of the statistics of rejections during the conscription of men from the United States for the Great War. There was such a widespread wave of astonishment and indignation that already thirteen States have passed laws requiring physical education as a compulsory part of the general school education, starting at the Primary Schools, and there are about an equal number of States that are considering similar laws. This has brought acutely before the educational world another question that was raised by Sir Leslie Mackenzie and by Dr Cruickshank, viz., the training of teachers, because there is no use in passing a law requiring a course to be given if you have not teachers able to give that course, and the work of training teachers capable of giving scientific instruction, both theoretical and practical, has been taken up by the Normal Schools and by a great many of the Universities, and there is now in many of them a theoretical as well as a practical course. At the University of Wisconsin, which is a State University, there is a four-year course for teachers in physical education, that is to say, they take about 20 per cent. of their course for the Bachelor's Degree in the technical work connected with physical training, like applied physiology and anatomy, the conduct of games in playgrounds, and subjects of that nature, the rest of their course being taken in the academic subjects, so that they are well educated in academic subjects, and are experts in this particular branch. These teachers are able to go to large schools, and to devote their entire time to the supervision and direction of the progressive courses of physical education, starting from the very beginning and going up to High School age. I am very much interested in hearing what has been done at Dunfermline. I have followed the development of the school at Dunfermline with great interest, and it seems to me that it is the nearest thing to a Central Institute such as has been conducted in Sweden since 1812. I hope that it will continue to develop and put out a continuous stream of good teachers. It is a good thing to rescue the subject from the kind of instruction given by the drill sergeant with whom we became so familiar during the War. In the Spring of 1915 I had the doubtful pleasure of taking the P.T. and B.F. course at the Headquarters Gymnasium at Aldershot, and, as most of the officers and non-com.'s who were taking that course were picked men of military

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age, I had to step a little faster than I usually do in order to keep up with them ; but I could not help being impressed with the extraordinarily accurate way in which it was fitted to the training of recruits who had to be brought under control and taught in the shortest possible time accurate, quick movement, and the aggressiveness which was necessary for the successful bayonet fighter. That requirement, fortunately, no longer exists, and it is necessary to change our methods. It is quite possible to give most exercise in such guise as to appear like play. That is why we have tried wherever possible to eliminate order movements or movements which are purely disciplinary in character, and to give the exercise in the form of a game which is enjoyed by the pupil or by the student. I think that the Swedish system of gymnastics—and that, of course, is a very controversial subject—as it was brought to England could not be called a complete system of physical training. The movements were analysed so that the meaning of them was lost and they became uninteresting. Hjalmar Ling designed most of them for the schoolroom. He could not give exercises on apparatus because there was no apparatus or space or time. That is one of the reasons why Swedish gymnastics must be an incomplete and partial form of exercise ; they will never be complete without the exercises which are more natural and spontaneous in character. We have found in the development of playgrounds, which I am glad to learn have been developed largely in Scotland as well, that with good direction it is the best possible place in which to train the character of children. I am glad that the question of the training of character was brought up in this discussion. Physical education is not merely the going through of movements. Playing of games is not merely the skilful doing of movements. It is the training of the whole point of view and the character of the child, and there is no way in which he can be got at so well as through the spontaneous or directed games of the playground. They say that at school a child learns but in the playground he really lives, and I believe that to be profoundly true. The great bulk of students look upon all their studies as lessons, and it is the comparative few who go in spontaneously for the mere love of learning. But when the student's interest can be awakened to the possibilities for pleasure of exercise or of a game, it is astonishing how he responds. I feel that if in my own college days I had known that Homer had written for any other purpose

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than to catch us out in parsing and analysing, I would have had a more sympathetic interest in him than I had. In the same way, I believe that if exercise is given in such a way as to interest the student, he will respond in a most unexpected and gratifying way. The public schools do tackle the problem of giving physical education as well as can possibly be done. We have the corresponding preparatory schools in America in which the privileged students are all given systematic exercise, in the form of games as a rule, and they usually enjoy them and come to College splendid, well-set-up young men. We don't want these young men to go into the gymnasium and take the elementary work; we want them to play football, and they naturally graduate on to the teams. This does not in any way interfere with the formation of voluntary clubs; on the contrary, it encourages it in the most marked way. I think our boxing, wrestling, football, and other clubs have increased three or four times in numbers, owing to the recruits drawn from our regular classes, from men who discover an unexpected ability in a certain form of exercise. I feel quite sure that Dr Sym would find that by trying the various games that are allowed in our course he would find some unexpected ability which would raise him into that chosen body of athletic geniuses of which I spoke. Dr Flett raises a very good question with regard to competitive exercise and also the number of men who would voluntarily take exercise. I think 10 per cent. is a very fair percentage to give for those who would go in for some form of competitive exercise. We find that 10 per cent. is composed of enthusiasts. Then there are about 40 per cent. who are mildly interested, who will perhaps engage in games if there is a certain amount of compulsion or if they know it is the thing to do, and that they are given credit for it. Then there are another 40 per cent. who will engage in sports, not willingly, but who will accept them as part of the troubles of life, and who in many cases afterwards discover that they like them very much. Lastly, there will be 10 per cent. who will be opposed to them first, last, and all the time, and who will try to get out of them, and it is astonishing how close this 10 per cent. corresponds to the number who are down in other subjects. We usually find that they are down in three or four subjects at the same time. I remember one man who came to me and said, "I don't mind exercise at all, you know, but I hate to sweat," and I had to explain to him that he would not get

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very far in this world without sweating. As to the accommodation that we have—we have a gymnasium building with a large hall about 146 feet by 70 feet, a smaller hall 100 feet long by 30 feet, and four smaller rooms for the accommodation of the boxing, wrestling, and fencing clubs. The gymnasium opens out on to a playing field with a quarter-mile track, on which the match games of football are played, and the track is used for the track and field athletics. We have also three other playing fields about the same size, and these are kept going pretty regularly. The accommodation is not enough for our needs, and we have to economise in every way. Sometimes we have the gymnasium floor divided into three by dropping nets. We have about twenty courts for tennis. That is not sufficient; we need more. At Harvard they have sixty or seventy. At other Universities the number of courts is practically unlimited. We have to do the best we can at Pennsylvania. In other sports, like golf and riding, we make arrangements with other clubs for our men to use them. With regard to the cost, I should say that the cost of the physical education would be about £2 a year per man. That is a very vague guess I should think, because the cost of running a football team alone is enormous, and is quite prohibitive if you did not take into consideration the fact that the match games, in which there is tremendous interest taken, bring in something like 80,000 to 100,000 dollars during the season. That money is spent in carrying on rowing and other games that bring in no revenue, so that, after all, it is the public who pay the freight, as we say. If there were the same interest or even an approximation to the interest that is taken in matches between Universities in football taken in field athletics and in other games; they would also pay their own way. It is purely a question of making these things self-supporting. In most of the clubs the men pay a small fee, and in some cases the University pays for an instructor, and in other cases they hire their own instructor. The ideal way is for the University to pay all instructors, and to have the income from physical education and athletics managed by a treasurer or some committee responsible to the University—the exact arrangement would vary with the Institution—one has to consider the various susceptibilities of the Institution itself. I am very glad that physical education has such a warm advocate as Dr Mackay. One who can take his exercise in the morning and can come

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through it as he has, should go far. I am also very proud to acknowledge my old friend Dr Meakins as one of my "ribs." He asks me about the number of men going to competitive athletics from the regular classes. The regular classes are the great feeders for the various teams. Last year we had eight men on the football squad that were developed in that way—developed from the classes. They took the classes for a while and they thought they could do better and were more interested in sport and went out for football, discovered they could play and developed into members of the team. In the same way we are continually finding a great many men who can run a great deal better than they thought they could do, or who develop an interest in boxing or swimming. In that way it is advantageous to the various clubs, and it has a good deal more than doubled the membership in nearly all the clubs. There is a profound truth in what Dr Meakins said about the value of a man being in good physical condition with reference to his daily output of work. I remember addressing a number of business men at their club, and in the course of my address I spoke of the danger of writing an important letter when one is tired, run down, and irritable, and of the steadying effect of a spell of exercise, a bath, or a shower and a rub down; after such a preparation the letter would probably be worded very differently, and sometimes it might make a considerable difference in his future business relationship with his correspondent. After I had finished, a business man came to me and said, "I want to thank you for what you said; I am just going back to my office to tear up a letter I wrote before I came out." With regard to the relation of the Hospital to the Department of Physical Education, we have at the Hospital a Department of Physical Therapy in which we give corrective massage and hydrotherapy; outdoor and indoor cases are referred to it, and it is run practically to its capacity. I believe that the best arrangement of such a Department—and I believe that every Hospital must have a Department of that kind to be complete—would be to have all of these remedial measures in one department and to have cases, both surgical, medical and orthopædic, referred to that Department with, if necessary, the directions for the special treatment of the cases signed by the surgeon in charge. That, of course, is the most economic way, it is the most efficient way, and it is the way the best results are got. The cases that are referred to the Department at the University Hospital depend

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on the man. Some members of the staff send their cases down in great numbers and other men do not. A great many cases are treated for cardiac conditions, and the length of the period of convalescence in fractures is greatly shortened by massage; we also see a good many of the cases which were so abundant during the war—nerve sutures, stumps, etc. We have also many cases among the students which are a little too advanced or serious to be treated by the simple corrective measures given in the College gymnasium by the gymnasium instructor. We don't feel that the gymnasium is the proper place to run a clinic. We feel that a man should only be given the simple exercises shown on the cards at the gymnasium, and anything further should be referred to the hospital. He should be brought to the water; whether he drinks or not is, after all, his own affair. He should be given the chance and have it pointed out. There are a great many men who would rather have the tailor pad their shoulders than take the trouble of raising a low shoulder to the level of the other one.

I cannot close without a reference to what Professor Caird said about the physical education for women. All that I have said about the physical education of the men and boys applies to women and girls. In the women's colleges practically the same kind of course is given, the same kind of examination is made, the same kind of prescription of exercise is given, and the results are even more gratifying in the case of the women than they are among the men. I think the women respond to these exercises better, they are more conscientious in carrying out the prescriptions, and the result has been a very marked and gratifying improvement in the condition of health, in the reduction of the number of days lost from their studies, and their general well-being. This, of course, after all, is a national question; it is not a question which can be considered as applying to any one small community or to one sex, and the crux of it will be the starting of physical education in the lower grades in the Schools and carrying it all the way through. The best time for it is in the growing years, and that is the time to carry it out, as I am glad to hear it is being carried out in Scotland with great efficiency. It would be ungracious of me to sit down without acknowledging the extremely cordial reception that has been given to me to-night—I can only say "thank you."

THE RELATION OF ART TO MODERN MEDICINE.*

By SIR DYCE DUCKWORTH, Bt., M.D., Hon. LL.D., Edin.

YOUR invitation to open the 185th Session of this ancient and famous Society came to me as a surprise, and afforded me much pleasure. It was certainly an honour that I never expected to enjoy a second time in my life. It appeared to be a bold duty to accept it so far ahead, but my heart was so much in it that I ventured to undertake this honourable position once more. Since my last address here fifteen years ago, it has to be noted that many important changes affecting our profession have occurred. It is of the essence of all knowledge to be progressive, and there can be no stagnation in a vocation such as ours. Verily *mutantur tempora*, yet, as I will try to show, there are principles and conditions attaching to our duties which must remain, and be regarded for all time.

It is generally noted that the influence of teachers upon their pupils in all Schools of Medicine is apt to remain for life. It has always been the case in this great School. It was very strong in my time when Christison, Syme, Simpson, Hughes Bennett, Goodsir, Laycock, Gairdner, Warburton Begbie, Lister, and Turner, not to mention many others, were in full power. Later came eminent teachers such as Fraser, Matthews Duncan, Sanders, Grainger Stewart, Joseph Bell, Crum-Brown, Wyllie, John Chiene, and Byrom Bramwell.

Preliminary, Literary, Scientific and Clinical Education.—

We note the revived recognition of the necessity of a good preliminary education for our entrants. Defects in this render the future studies more difficult to acquire. The nomenclature in modern medicine is largely built up in Greek terms, which must impede anyone void of some knowledge of that language. In France and Germany, and now in this country, many newly discovered morbid conditions are mixed up with the names of the men who detected them—hyphenated, and often sesquipedalian, so much so that no brain can retain them. Modern chemistry is now set forth in terms which become a terror for students. Seventy-eight years ago Dr Graves, of Dublin, wrote that “we almost feel as if some enemy to

* Inaugural Address delivered on the opening of the 185th Session of the Royal Medical Society of Edinburgh on 14th October 1921.

Sir Dyce Duckworth

our profession had invented the chemical nomenclature for retarding the progress of medicine." What would he have to say in these days?

In 1923 no students will be allowed to begin their strictly professional studies before the age of seventeen years. The latest requirements for securing a medical diploma appear to surpass those which are demanded for any other learned profession; and, if fully carried out, must entail a period of six or seven years of hard work.

One of our best leading teachers to-day declares that "medicine is perhaps the most complex and most dependent upon other sciences for its development. Hence it is from outside medicine that the chief stimuli to progress in medical science have come."¹ Yet he recognises the great progress which generally accrues from careful clinical studies.

While fully accepting these views, it must be stated that a purely scientific education by itself, however conducted, can never produce skill or essential personal qualities of a practical physician at the bedside. Science is a key to Nature's processes, but the application of the mind trained both in literary and scientific studies is the only condition with which to equip the best clinician. It is hard to resist the question how many of our young aspirants in the present stirring days will be able to secure the whole of this equipment for their profession. We must agree with Karl Pearson that "science in its application to mankind is the only science of value." At least, let us be hopeful and helpful in the days to come.

Modern Clinical Changes.—The numerous changes in the methods of practical medicine are almost overwhelming to understand and appreciate. Morbid anatomy alone in its new details has become almost a study of a life-time. Chemistry, bio-chemistry, X-rays, radium treatment, the recognition of numerous septic and vicious microbes, of various vaccines, sera, and the qualities of the endocrine glands, and of vitamins and their influences on other vital processes, have all been displayed with remarkable results in many instances. Attention is now directed to new studies in psychology and psychotherapy. All these suggested additions to our therapeutic knowledge demand active clinical study and precise teaching. The specific actions of some long-known efficient drugs have now been disclosed by ingenious laboratory methods, and their value explained—verily examples of old clinical empiricism of which,

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doubtless, more remain to be discovered. (I am disposed to add, parenthetically, that I believe there will always, or for years to come, be empirical employment of many practically useful drugs approved by clinical skill.)

It has been wisely remarked that "the Principles of Medicine are its elementary facts, not immutable laws, or methods of treatment. The complex nature of man renders each patient a special study."²

The first object for the physician is the study of the individual patient, the second one the nature of his disease. I have to admit that I have formed the opinion in recent years that many of us have been paying more attention to the *disease* than to the *patient*. The former inquiry relates largely to *science*, the latter to *medical art*. We need both. For example, the old term *diathesis* is never mentioned in these days, that is, the textural or tissue-quality and its special proclivity in the individual patient. There is surely a personal textural tendency, not seldom blended with another, in each one of us. No one who studied here under Laycock left this School without this important teaching. This is purely a clinical study which cannot be pursued in the laboratory. We thus seek to discover the influence of disease on the particular patient. Family history often comes in to suggest the inherited habit of body that we have to deal with, and its special proclivity. These views are happily likely to spread in the future, since it has now been ascertained that the body of man reacts as an organic whole, and not as a set of independent units. Each soil, animal or vegetable, has a behaviour of its own. This accounts for many varied clinical revelations, witnessed in daily practice, some of which can be demonstrated by careful inquiry and attention. To give but one example in regard to the occurrence of tubercular invasion. A family history of this disease is always of importance. We may fully recognise the two frequent conditions of insanitary environment, or imperfect nutrition, obviously bearing on the case, together with some physiognomical features plainly indicating a strumous habit of body. The outlook here is probably grave. In other instances we find no family history of tuberculosis, but discover definite evidence of infection present. The general appearance does not conform with the characteristic features of struma. Inquiry here as to the family history of ailments may elicit a clear history of gout, or gouty

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ailments, on one side of the family ancestors. This is an important element in the case, and should encourage a more favourable prognosis for the patient, on the ground that tubercle bacilli abhor goutily disposed tissues, and are often overcome by them. My own experience fully justifies this assertion, and it results from long clinical observation. So far, the laboratory has not yet given us any reason for these textural qualities. This view is well recognised in the French Schools, and the results, as followed up clinically in after-life, are very noteworthy. We may thus safely affirm that a strumous habit of body is largely protected throughout life by a gouty ancestry in the family. Physiognomy is little studied in these days. Much may be gained from a study of good family portraits, when possible, in relation to the textural tendencies of offspring.

Amongst recent researches we note the achievement of some improved methods of investigation of cardiac disease, and efforts to produce more exact definitions of the nature and origin of many nervous disorders are in progress.

It is now recognised as important to study the earliest indications of failing health with a view to avert their progress. In this connection we may recall Sir F. W. Andrewes' opinion that the chief issues in physiology and pathology, in the future, are to be sought in the chemical activities of the body, which mainly consist of colloidal compounds.

We may fairly expect that some of the special studies now proposed to be included in the pupillary years may be more profitably met by post-graduate courses which are now well established in our leading schools.

Modern Medical Literature and Advertisements.—In the last half century the literature of Medicine in this country and abroad has increased enormously, and has passed beyond all means of useful study by active practitioners. Happily for us, our well-conducted Journals secure the most profitable fruits of it for ready consideration and use. Even these sometimes suggest new methods of treatment founded on inadequate observation, constituting temptation to displace the attention of the busy practitioner for his attained practical experience, leading to failure and disappointment. The latest therapeutic "novelties" are not seldom snares to the unwary, but none need fear the suggestions of *exact science* emanating from any source. I venture to think that we are not adequately informed

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as to the failures of many vaccine treatments now widely practised.

The new treatment by various endocrine secretions has established some remarkable facts in clinical practice. I am reminded in this matter of our complete ignorance of the functions of the adrenal glands at the time when I was preparing my graduation thesis here on these bodies. My effort was more particularly confined to study the relation of the large nervous supply to their medullary portion, which was then conceived to be of higher importance than the cortical investment. We now know the varying qualities of the secretions of each texture of these remarkable bodies.*

We cannot doubt that, as Sir Frederick Mott has stated in his Morison Lecture, delivered here this year, "the foundation of endocrinology has revolutionised our ideas of medicine, and promises to illuminate the darkness of many diseases, including those of the mind."

He specially notes the earlier contributions to this subject from Sir Thomas Clouston, Professor Schafer, and Dr Byrom Bramwell, all emanating from this School.

Treatment is now suggested of a combination of all the endocrine secretions for various ailments. This recalls the old "blunderbuss" prescriptions of two centuries ago, and as yet has probably no clinical justification. We may regard these for the present as suggestions of pseudo-science, and, indeed, we have too much of this set before us by manufacturing chemists here and abroad. In the wild hurry of to-day it is not realised that therapeutic novelties and methods require long and severe clinical study.† The frequent announcements

* It is now asserted that adrenalin is not a normal product in the blood. Dr Golla declares that we have no reason for the belief that the activity of the nervous system can be materially aroused by this secretion, and asserts, further, that glandular structures in the normal body are not inert of themselves to furnish afferent impulses to the central nervous system. ("Objective Study of Neurosis," Croonian Lectures, 1921. *Lancet*, August 1921.)

† Professor Bolk, the distinguished anatomist of Amsterdam, regards the endocrine system as a controlling *imperium in imperio* in our bodies, judging the quality and intensity of the chemical substances produced there, and regulating the nature and the quality of them by means of their hormones. From an artistic and clinical point of view we may fairly wait for further accurate knowledge before making experiments on our patients with multiform hormones in this direction. ("The Part played by the Endocrine Glands in the Evolution of Man," *Lancet*, 10th Sept. 1921.)

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in the public press of the newest alleged remedies and methods of treatment are, I believe, practically harmful to many of their readers, and no less to patients who are eager to try them, or to urge their unhappy attendants to prescribe them. These novelties are, further, mischievous in withdrawing full confidence from their attendants, and diverting attention from older remedies long approved by the skill and brains of our shrewd forefathers. I, therefore, regret to find so many valuable and approved agents removed from the last edition of our Pharmacopœia, and I know that I am not alone in that opinion. Again, I am fully assured that the very limited list of the *Materia Medica* now suggested, from *non-clinical* sources, and recommended as adequate for teaching in our Medical Schools, is insufficient, and shorn of many drugs well worthy of confidence.

It appears to be forgotten that the therapeutic action of any remedy is never seen except in disease. One meets in these days with prescriptions consisting of several laboratory products, not one of which is recognised as of real service—sad examples, indeed, of imperfect training, and absence of all clinical art in the prescriber. Let it be recognised that the last words in this matter must always rest with skilled clinical observers, and with no other persons. Eighty-one years ago, Goodsir remarked that “common sense, supported by long-headedness, experience, and tact, was a faculty of more use to the physician than all the science of Newton.”³ May our younger brethren keep this wisdom in mind in the days to come. They will surely need it.

We must take note of an instance in which exact science has failed to aid the physician in his prescription of alcohol in any form to meet the requirements of morbid conditions. Many elaborate experiments have been carried out on small animals, illustrating various facts which naturally indicate the poisonous effects of poisonous doses of alcohol. These laboratory results are pressed upon our profession with a view to urge our renunciation of alcohol as a dangerous and useless agent in the treatment of the sick. The careful and experienced physician finds these opinions of no moment to him, for he has long acquired the art of prescribing various forms of alcohol with distinct benefit when indicated; and it is his duty, if a teacher, to give clinical instruction about them. At the present time, I believe that the average student often begins to practise without an intelligent training and acquirement of the value of any form

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of alcohol in disease, its benefits and its dangers—especially to women. This is a *clinical* question, it relates to the *patient*, not to the *disease*, and must be as carefully prescribed as any article in the medical prescription when indicated.

We must, however, recognise the value of more recent research on the influence of alcohol on the *working powers of healthy men*, which indicates that it is void of real aid in these conditions, and tends to diminish the output of energy to some extent. When a worthy amount of *honest* work, cerebral or muscular, is accomplished, careful observers discover by experience that the strictly moderate use of some diluted alcoholic beverage may, if desired, be taken with some meal, later in the day, with absolute benefit, and with refreshment of the body. These facts should be made widely known to the public. I should regard total abolition of the employment of all alcoholic liquors as distinctly harmful in many ways to the welfare of any enlightened Christian country.

We are now establishing research laboratory work as an appendage to bed-side teaching, in which our clinical students are to take part. It can hardly be easy for them to engage at once in elaborate research together with careful observation of all their patients' symptoms and requirements. They will, however, better understand the methods of modern clinical research.

A new method for our consulting duties is now set before us in a scheme of so-called team-practice, in which the conjoint skill of a company of various experts is enlisted for the full benefit of the patient. This is an import from our American *confrères*. I confess my inability to understand how such an arrangement can be conducted with comfort, privacy, and the fullest consideration for all the requirements of the individual patient. The cost of this scheme must always be large, and beyond the means of any but wealthy persons. My experience has long taught me that patients of both sexes are not desirous of seeing many doctors during their illness. I foresee also a danger in this system which is only too likely to diminish the patient's regard for the skill and personal qualities of his ordinary attendant. It is not in accordance with British ideas to consult a commercial company when suffering from illness. The most approved new healing skill can well be reached by simpler and private methods, and will, I believe, continue to be so secured.

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In another direction we have sadly to note the general failure of the Panel system in this country, which has so largely degraded both science and art, and lowered the government and public respect for our worthy practitioners.

We have also to consider at this moment the serious political changes which have in recent years placed our beneficent profession under bureaucratic influences and tyranny which, in my opinion, are very injurious to its honour, independence, and dignity, and, no less, to the highest welfare of the public, who may have to suffer under this costly and unnecessary burden.

It is not possible in this address to omit a full recognition of the splendid medical and surgical achievements of our profession, and those of our professional allies, in the late ghastly war. These were evolved by a service of humanity, and conducted with scientific and artistic skill, resulting in a saving of life and limb which will remain on record for all time. Many of their discoveries have led to modification of practice with lasting benefits to the world.

The Artistic Side of Medicine.—I have endeavoured, so far, to express the claims for science in our profession. These must remain and increase, and be wisely employed. There are, however, other methods which stand for much in ordinary daily practice, and may never be disregarded. These relate to the Art of Medicine. It may be affirmed that half a century ago clinical practice was generally more artistic than scientific. There were, however, at that time many leading physicians making discoveries as to minute normal and morbid anatomy, and to the more exact and physiological actions of drugs which had long been in empirical repute for certain ailments.

We have recently been told that "medical and surgical practice now consists in the application of scientific methods." I venture to maintain that this declaration is distinctly incomplete because it omits to note the intrinsic value of the artistic side of our vocation. Without this, much of our work would be shorn of its power and usefulness. The relation of Art to Medicine is purely clinical in practice, and is only to be acquired and manifested at the bedside. The applications of science are tested there by trained observers with reference to their value and superiority to older remedies of repute. The varied phases of diseases often call for interruption of standard methods which may admit of

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no sanction from science, and artistic experience alone justifies the practice.

One feature of medical art is a sound practical knowledge of the remedies which *distinctly do good*, and *relieve the patient*. Too much science tends to lessen the acquirement by the student of sufficient practical clinical knowledge. The trained medical artist observes the intimate connection between his patient and the disease. He sometimes discovers that the influence of some remedies is more satisfactory when used in their natural form, as in the cases of opium and cinchona as compared with their alkaloids, and of imitations of salicylic acid.

We have to note that real art is modest, and not conscious. "It never interprets itself." As Buffon expressed it, "Le style est l'homme même." In theory, the pure artist is a social being. The pure scientist is apt to be more concentrated.

I have sought the opinions of a few of the best known clinicians on the relation of art to medicine. Ages before the Christian era the first aphorism of Hippocrates reminds us that "Art is long," or tedious. *Sydenham* noted that "true practice consists in the observations of nature; these are finer than any speculations. Hence, the medicine of nature is more refined than the medicine of philosophy." *

Boerhaave wrote: "I do not know anything which is more prejudicial to the noble and generous art of physic, or more able to reproach contempt of such credulous people as are always ready to try everything that is cried up, and then find by their own experience that they were deceived."

Trousseau, one of the greatest of French physicians and clinical teachers in the last century, declared that "All science touches art in some degree. All art has its scientific side. The worst scientist is one who is never the artist. The worst artist is never the scientist. Practically, there are methods in the sciences, in the arts there are none. Method and art are reciprocal. Science excludes individuality. When you have studied the scientific facts relating to medicine, beware of considering yourselves as physicians. These facts only give you the opportunity to rise to the higher position of the medical artist." †

* Sir Frederick Andrewes describes him as "a pure clinical physician," and "disdainful of science," although he was the founder of epidemiology (p. 21).

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Sir Thomas Watson noted that "our art requires skill in observing, as well as in acting."

Stokes, of Dublin, believed that "medicine was not yet a science, but was about to become one." All of his pupils recognised his great artistic powers, and his renowned contemporary, *Graves*, was also famous for his clinical insight, which was highly appreciated and often quoted by *Trousseau*.

Sir William Savory, as a surgeon, declared that "artistic power and element will never cease to be part of the equipment of the best physicians. It is because medicine is not an exact science that the man of observation and experience has so enormous an advantage over others; that is why he knows more than he can teach. Professional skill cannot be transmitted."

Sir William Gull always insisted on the "personality of the patient," and enforced the necessity of seeking hereditary tendencies to disease. He was considered to be as competent in the capacity of a skilled nurse as he was as a physician. He wrote that "Science and common sense differ as cultivated fruits differ from wild fruits." "The patient should be considered as the disease plus the patient."⁵

Dr Pye-Smith regarded the art of medicine "as not connected with disease in the abstract, but with pains and discomforts, the causes, seats, and origin of which the physician seeks to find, and, if possible, to cure in each case."⁶

I am reminded on this occasion of one of the brightest of the physicians in this school in my time, who exemplified more of the combined scientific and artistic spirit than many of his day. I refer to *Warburton Begbie*. His interest in pathology was as great as his faith in therapeutics. He acquired the invaluable faculty of clinical intuition by close observation. With him, the student learned manners as well as physic, and diagnosis as well as sick-nursing. His own master, the eminent *Dr Pulteney Alison*, was a great physician from whom he learned much. As one of *Begbie's* former resident-physicians in the Infirmary remarked after his master's too early death, "How much greater and better was *Begbie* himself than anything he ever wrote."*

I suppose that all who had the privilege of knowing *Lord Lister*, as teacher or friend, would accord to him the highest recognition as a humane and artistic surgeon. The influence of art as expressed in modern practice of surgery, developed

* The late *Dr Wm. Jeffrey*, of *Jedburgh*.

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by careful research, is seldom far to seek in these days. The surgeon now wields more powers and methods than are available for the physician in his sphere of action.

For all of us, Art in Medicine is purely an individual and personal acquirement. It can only be sought and acquired by close clinical observation and reflection on the daily experiences of our contact with the sick amongst all classes of patients. The President of the British Association, in his final address to the British Association, in this city a month ago, declared that science was on the verge of a new epoch. Let us hope that whatever happens to the scientific side of medicine in that epoch may not fail to increase an interest and practice in the cultivation of its artistic power.

I regard the views of the late thoughtful James Martineau as very apt in relation to our vocation. He wrote that "what the physician learns constitutes the very substance of his profession, the value of his skill, and only in virtue of its contents is he what he is. His occupation is an Art, and the perfection of his art lies in the perfection of his knowledge, and of its application. So much for the Art. But there is another element which must be seriously taken into account and blended with the study and the subsequent practice of his attainment, and that is the perfect humanity of each practitioner sympathising in dealing with his fellow-creatures."⁷

Our Art, indeed, consists in humanity dealing with humanity on every occasion. It is no less than the religious environment of our professional duties. The patient is no subject for mere experimental excursions. Art gives tone and solemnity to our work. Happily, in these days, we never hear mention of the old apophthegm, "Ubi tres medici, ibi duo athei," for we are protected by our artistic element in full action. This alone sanctifies the splendid additions of approved progressive discoveries and scientific methods. It imposes upon all of us the duties of employing the highest skill, and of inspiring confidence in our patients. It carries with it an equipment of sympathy and good manners, with high tone, hopefulness, and cheerfulness.

I venture to press home to my younger brethren the fact that Art must ever be an abiding quality and part of our profession. No progress of pure science can abolish, or lessen, it for all time. Can we omit to declare that one feature of the *ars medica* is a power to recognise our daily duties as

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distinctly Christian services, requiring our constant attention to the fact that each patient has an implanted and immortal soul, which cannot live apart from the perishing body? This belief raises our efforts to the highest possible standard, and brings us into active co-operation with the only perfect Humanity this world has ever known.

My last words are for those who are already more or less advanced in *statu pupillari*, and have joined this venerable Society to make worthy friends and provoke one another to forensic courtesy and high attainments.

The older members of this Society will never fail to tell of the value and the impulses they received from its good fellowship. Such experiences are a great power in the formation of a high character, a quality of the highest importance in our profession. Character is not skill, and, alas, skill is sometimes met with apart from high character in all the professions.

The artistic side of your work, which must be begun early, will, of itself, help to refine your life for all time.

In this dear old centre, may the spirits of the past who have left their records here inspire many of you to take the highest line in all your pursuits, both as undergraduates and graduates in the days to come!

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THE SURGERY OF NASAL DEFORMITIES.*

By DOUGLAS GUTHRIE, M.D., F.R.C.S.E.,

THE remarkable achievements of plastic surgery during the war led to a hope that the experience then acquired in the treatment of facial injuries might be applied to the repair of minor deformities and disfigurements such as are frequently seen in civil practice.

Nasal deformities are probably the most numerous of all facial defects, and whether they are congenital or the result of injury or disease, they often cause much distress to the patient and may even render him unfit to mingle with his fellows or to earn a livelihood.

Anatomical Data.—A few anatomical facts regarding the structure of the external nose may be mentioned as an introduction to the subject.

The nasal bones, on account of their position, are very prone to dislocation or fracture. They rest on either side upon the ascending processes of the superior maxillæ, which constitute the main scaffolding of the bony framework of the nose. When it is necessary to mobilise the entire nose upon the face, in order to correct a deformity, those supporting buttresses must be divided.

The soft, distal part of the nose is supported by two sets of cartilages. The upper or triangular cartilages are united in the middle to form one plate, and on its under surface this plate is fused to the cartilage of the nasal septum. The lower or alar cartilages support the nostrils, and from each of those cartilages a prolongation or inner limb passes along the side of the columella. This inner limb or process may become displaced into the nostril, causing deformity and obstruction. The nasal septum—built up of vomer, perpendicular plate of ethmoid, and quadrilateral septal cartilage—also has an important bearing on nasal deformities.

Causes of Nasal Deformity.—Any or all of the parts just described may be fractured or displaced by injury, and it is important to restore the fragments *immediately*, if deformity is to be avoided. A strong pair of forceps, with broad, thin blades, is useful for this purpose. No special splints are required. The septum must be carefully straightened, as a large proportion of

* Communicated to the Medico-Chirurgical Society of Edinburgh,
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deflected septa are the result of previous injury. Injury to the septum is out of sight, and is therefore liable to be overlooked.

While malunited fracture of the nasal bones and cartilages is the most frequent cause of nasal deformity, certain cases are the result of disease, such as lupus or syphilis. The deformity caused by injury may sometimes closely resemble the saddle-nose of syphilis.

Varieties of Nasal Deformity and their treatment.—For purposes of convenience, nasal deformities may be classed under three headings. In the present paper, no reference will be made to total or partial loss of the nose, and its treatment by rhinoplasty.

The three varieties of deformity are—first, lateral deflection or twist of the nose ; second, sinking in of the bridge, or saddle-nose ; and third, deformities of the orifice of the nostril.

Lateral Deformity.—Lateral deformity of the nose is limited, as a rule, to the soft, cartilaginous portion, the bony part escaping, or participating only to a small extent. The twist is accompanied by nasal obstruction, due to deviation of the nasal septum, and when the obstruction has been treated by submucous resection of the septum, it will usually be found that the deformity has been cured also.

This fact was illustrated in the writer's practice by a youth of 18, a keen boxer, whose nose was so sharply twisted that he presented a grotesque spectacle. Both nasal cavities were completely obstructed—a somewhat rare phenomenon. The twisted and crumpled nasal septum was resected by the submucous operation, and the nose then assumed its natural position. Only on rare occasions, when the bony part of the external nose is involved, is it necessary to divide the ascending process of the superior maxilla (Marshall's operation) so as to mobilise the nose and correct the deformity.

Saddle-nose.—The second variety of nasal deformity is the sunken or saddle-nose, a common result of injury and of syphilis. Diagnosis of the cause is not always easy, and in two of my cases, due to injury, the appearance was most suggestive of congenital syphilis.

Treatment of this type of deformity by transplantation of costal cartilage, so as to form a new "bridge," gives excellent results. It is generally known as Carter's operation, and is performed in the following manner. A transverse incision is

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made at the root of the nose, down to the bone, and the soft tissues are then separated and elevated as far as the tip, and along the sides of the nose. Into this pocket a strip of costal cartilage is inserted, the seventh costal cartilage being most conveniently utilised. Access is gained by a vertical incision in the costal margin, and after splitting the rectus muscle a short length of the entire thickness of the cartilage is removed. The cartilage graft is then carefully pared down to a suitable shape, which has been previously ascertained by measurements. A small wire model representing the size and shape required may be sterilised along with the instruments. Having placed the graft in position, the nasal wound is united by a couple of stitches and finally the thoracic wound is closed. The nasal wound requires no dressings and heals rapidly, with a trivial scar. Access by intranasal incision, advised by some surgeons, is difficult and is prone to sepsis.

During the past year the writer has operated on seven cases of saddle-nose. Two cases were the result of syphilis—one followed a nasal operation, presumably submucous resection of septum, and the remainder were due to injury.

On only one occasion was the result unsatisfactory, a case of extensive syphilis, which had destroyed the premaxilla and septum. The sunken bridge was restored by cartilage grafting, but as the entire nose had collapsed as a result of the disease, the result was not pleasing, although, strange to say, the patient was delighted. It need hardly be remarked that no operation should be undertaken in syphilitic cases until all lesions are healed and the disease cured. When the destructive process has mainly affected the nasal bridge, syphilitic deformities may be perfectly corrected by cartilage grafting, as the accompanying photographs (see Plate, Case I.) show.

This girl, aged 18, kindly sent to me by Dr Logan Turner, was the subject of congenital syphilis, which had destroyed the nasal bridge and the columella. Costal cartilage grafting and reconstruction of the columella from the upper lip yielded an excellent result.

As an example of saddle-nose due to injury, illustrations are given (see Plate, Case II.) of an officer who injured his nose in an aeroplane accident and whose appearance was such that, on demobilisation, he found it difficult to secure employment as a metallurgist. Immediately after the operation of cartilage grafting, he took part in an expedition to Spitzbergen, thus

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subjecting the transplanted tissue to a severe test, but the extreme cold had no deleterious effect.

The third patient here illustrated (see Plate, Case III.) was a young lady, aged 20, who fell downstairs at the age of three, injuring her nose severely. The unsightly deformity was corrected by a graft of costal cartilage, and the second photograph shows the result.

Deformities of the Nostrils.—To illustrate deformities of the nostrils, three examples from personal experience may be quoted. The first is that common deformity caused by a projection of the lower border of the septal cartilage and of the inner limb of the alar cartilage. Treatment is easy and consists in the excision of the projecting knob of cartilage.

A rarer variety of deformity of the nostril is that which follows injury. The girl (see Plate) whose nasal bridge had been destroyed by syphilis had also suffered loss of the entire columella, so that the nasal orifice consisted of one large opening. By raising a flap from the skin of the upper lip, the columella was restored and the nostrils reconstructed.

The reverse condition, stenosis of the nostril, was exemplified in a girl whose nose had been bitten off by a horse, and who consulted me a year later. The accident occurred in America, and was treated there by reconstruction of the missing tip and left ala nasi from the skin of the forearm, *i.e.* the old Italian method of rhinoplasty. The immediate result was good, but by the time I saw her the left nostril had become so contracted that it would scarcely admit a knitting needle.

A satisfactory nostril was obtained by excision of the scar tissue, and the advancement of small skin flaps to cover the raw area.

Another type of deformity of the nostril is that which accompanies harelip. The following is an example:—

A man whose harelip (unilateral left) had been successfully repaired in childhood suffered from left-sided nasal obstruction, due to collapse of the left ala nasi. This was treated by splitting the ala and inserting a strip of cartilage obtained from the nasal septum. The obstruction was relieved and the appearance improved. (Photographs of those cases were shown at the meeting.)

Additional Notes on Cartilage Grafting.—The pioneer work of Major Gillies and others during the war demonstrated the suitability of cartilage for the rebuilding of facial defects.



CASE 1.



CASE 2.



CASE 3.



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Its advantages are that it is a natural tissue, that it persists unchanged when implanted in soft parts, and that it may readily be cut and carved to any desired shape.

Surely the patient's own natural tissue is to be preferred to metal, or celluloid supports or even to paraffin wax. The danger of paraffin injections—embolism, infiltration of eyelids, etc., cannot be lightly regarded. In one of my cases it was necessary to dissect out a mass of paraffin which had increased, rather than diminished, the disfigurement. Some operations advise the use of bone rather than cartilage. Lemaitre states that bone is less liable to infection, but this has not been my experience. The readiness with which cartilage may be shaped to suit the case is to my mind a great advantage. When a thin strip only is required, cartilage from the nasal septum may be utilised, but as a rule the saddle-nose defect is such that a thick segment of costal cartilage must be inserted. It appears to be immaterial whether the cartilage is transplanted with its perichondrium or without it. The use of the cartilage graft need not be confined to nasal surgery. Its value is not yet fully recognised, and it may come to be used largely by the general surgeon as a substitute for metal plates and filigrees in the treatment of cranial defects and of large herniæ.

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DESCRIPTION OF PLATE.

In each case the left-hand photograph shows the patient before operation, the right-hand photograph after operation:—

CASE I.—M. C., aged 18. Saddle-nose and loss of columella, due to inherited syphilis. Treated by costal cartilage transplantation, and reconstruction of columella.

CASE II.—P. M., aged 21. Deformity of nose due to aeroplane crash. Restoration of bridge by costal cartilage graft.

CASE III.—I. I., aged 20. Injury to nose at age of three. Deformity corrected by costal cartilage transplantation. The discoloration of skin is due to iodine.

NEW BOOKS

Surgery: Its Principles and Practice. By Various Authors; edited by W. W. KEEN, M.D., LL.D. Supplementary Vols. VII. and VIII. Pp. 1815, with 1016 illustrations. Philadelphia and London: W. B. Saunders Company. 1921.

Professor Keen was happily inspired when he decided soon after the Armistice to supplement the six volumes of his *Surgery* by two additional volumes incorporating the surgical lessons of the war, as well as the progress that has been made in civil surgery since 1913. The list of his coadjutors in this enterprise is too lengthy to quote, but it includes only names of recognised authorities on the subjects allotted to them, and the result is a complete record of the present-day position of surgical knowledge.

Space forbids that we should enter into a detailed analysis of such a comprehensive work, and to select would be invidious. The seventh volume is principally concerned with military and naval subjects, but throughout the application of what was learned in warfare to the practice of surgery in civilian life is clearly indicated. The eighth volume deals more with the advances that have been made in general surgery, and will prove invaluable to the reader who has been unable to keep abreast of contemporary literature during the years that have elapsed since the original work was completed.

Professor Keen has provided us with such an excellent work of reference, rendered the more accessible by the accompanying index to the entire eight volumes, that we forgive the American spelling he has imposed even upon his English collaborators. To this we have become accustomed, although perhaps not reconciled.

In its completed form, *Keen's Surgery* is a worthy monument to its distinguished editor, to American surgical literature, and, we may add, to the American publisher's art.

China and Modern Medicine. By HAROLD BALME, F.R.C.S.(Eng.), D.P.H., Dean of the School of Medicine, Shantung Christian University, Tsinan, China. Pp. 224, with 6 illustrations, and map of China. London: United Council for Missionary Education. 1921. Price, cloth 5s.; paper 3s. 6d. net.

The author of this fascinating book writes from personal knowledge acquired during long residence in China, and by a close study of the subject. The two and a half pages of literature recorded at the end of the book and referred to in the text are evidence of extensive reading. Dr Balme is evidently a large-minded man who discovers good even

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when it is obscured by evil, and he takes long and unbiassed views of economic and political problems. Until recently medical practice in China consisted largely of quackery, superstition, and exploitation, consequently it was held in disrepute by the educated classes. Medical missionaries, by kindness, caution, and great patience involving much self-denial, have awakened in the minds of the educated and the rising generation the desire for Western methods and science. A beginning has been made towards the satisfying of this desire, but only a beginning, and this book has been written in order that Britain and America may know the needs of China and the dangers to the world of insanitary conditions which exist in that vast kingdom, with the hope that there may be instituted a deliberate, far-sighted, undenominational policy "for the devolution to Chinese shoulders" of medical education and administration.

Life of Elie Metchnikoff (1845-1916). By OLGA METCHNIKOFF, with a Preface by Sir Ray Lankester, K.C.B., F.R.S. Pp. xxiii. + 297. London: Constable & Co., Ltd. 1921. Price 21s. net.

The name of Elie Metchnikoff stands high in the roll of those who have devoted their lives unselfishly to the service of biological science. Following a strong natural bent he took up the study of zoology, and for years he struggled to find an environment in his native Russia where he could carry on his investigations on the lower animal forms, unfettered by personal and political intrigues. This denied him, he sought refuge in Paris, where the master himself welcomed and sheltered him in the Pasteur Institute. There he worked while strength remained; thither he crept back in the dark days of war, to die; there his ashes rest.

The story of Metchnikoff's life as told by his wife in this fascinating biography reveals a personality of singular charm. Despite much discouragement in his early days, and periods of profound depression, he maintained his courage, and worked with singleness of purpose and scientific sincerity on the various problems of cell life, which eventually led to the discovery of the phagocytic action of cells as a protective and curative agency in disease. The gradual evolution of the theory of phagocytosis, and the explanation it furnished of the processes involved in immunity, forms one of the romances of biological research. The reader of this record of Metchnikoff's struggle to obtain acceptance for his views must be struck by its close resemblance to that of Lister. The same opposition, even in the highest scientific quarters; the same embittered controversies; the same rebutting evidence by further experimentation; and finally, the same triumphant vindication.

Parallel with his scientific researches on the vital phenomena of

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life, Metchnikoff was evolving a philosophical theory regarding the normal cycle of human life—what he termed *orthobiosis*—the significance and suggestiveness of which is abundantly illustrated in his own life, and in the poignant record of his last long illness.

Madame Metchnikoff, herself an accomplished biologist, has written a biography worthy of the man whose life and work are recorded. In its success as a literary effort the unnamed translator will surely share.

Medical Conduct and Practice. By W. G. AITCHISON ROBERTSON, M.D., D.Sc., F.R.C.P.E., F.R.S.E. Pp. viii + 168. London: A. & C. Black, Ltd. 1921. Price 6s. net.

This book is not homogeneous in its excellence. The first few chapters are a mixture of ethical platitudes which err on the low side of an attainable standard, and tips in bedside manner which suggest that manners constitute courtesy.

The section on operations has two serious blemishes. "It is advisable when you think that an operation is likely to be necessary to prepare the patient for it some time previously by slight allusions to the beneficial results which would follow" (page 139). This is wrong; such behaviour would probably persuade the patient that you did not know your own mind. Again, "In cases of criminal wounding you ought never to operate unless it is absolutely necessary to save the individual's life." What about a policeman who has got his finger tendons cut by an armed burglar?

In the section on Fees the author shows ignorance of the National Health Insurance Act. Whatever its faults are it does not provide "practically free attendance for men earning from £4 to £8 per week."

These are a few misprints: "More" for "Brown," on page 54, Scopolomine (p. 51), and a few grammatical slips.

The last part of the book is the best. Chapter XI. is especially good. Chapter XVI., on Book-keeping, is concise and lucid, but we think does scant justice to the card index system.

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A Treatise on Hygiene and Public Health. By B. N. GHOSH, F.R.F.P.S. (Glas.), and J. L. DAS, D.P.H. (Cal. Univ.). Fourth Edition. Pp. 507 + xxiv., with 62 illustrations. Calcutta: Hilton & Co. 1921. Price 9s. 6d. net.

If the contents of this well compiled and handy volume represent the standard of education on Preventive Medicine in India, we have no cause to fear the future of Hygiene among our sister Universities abroad. The book is well written, and its teaching safe, sound, and reliable. It is not rudimentary, as many students' treatises incline to be. In fact, one could safely recommend the volume to more advanced students than those seeking to pass ordinary degree examinations. We were impressed by the chapters dealing with Parasitology and Preventable Diseases. They are very well done. A decided omission, which must be rectified in a succeeding edition, refers to the question of Venereal Diseases. Child Welfare is discussed; but that big problem in Preventive Medicine, Venereal Disease, omitted.

Human Embryology and Morphology. By ARTHUR KEITH, M.D., F.R.S., LL.D., F.R.C.S. Fourth Edition. Pp. viii + 491, with 490 illustrations. London: Edward Arnold. 1921. Price £1, 10s. net.

That, again, eight years have elapsed since the publication of the previous edition, the war must be held responsible, for this book retains its place in the hands of senior students and of practitioners as *the* authoritative exposition on its subject. The new edition is slightly enlarged in size. Although only sixteen additional pages have been introduced, the gain of two or three lines per page, and a little compression of some diagrams and of the letterpress, have resulted in a material increase of the information contained. Thirteen diagrams have been advantageously replaced, twenty-one have been discarded, and sixty-two new ones added. As would be expected, the new diagrams occur mostly in the parts devoted to the general development of the embryo, and to the special development of the nervous system. Special chapters have been assigned to "the notochord and somites," to "age changes in the embryo and foetus," and to "the structures developed from the primitive pharynx." It is a satisfactory improvement that the prosencephalon and the circulatory system have each two chapters allotted to them; while the urogenital system and limbs are dealt with, each in a single chapter.

We cannot approach this excellent volume in a spirit of criticism,

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for it fills, and adequately fills, a position no other work attempts. We feel that the author with his unrivalled knowledge might, with universal approval, double the size of his book. Abnormalities are so varied and their record so scattered through literature, that a work dealing fully with them and their relation to ontogeny and phylogeny would be most acceptable.

We miss a reference to Browne's work on anencephaly published in the *Edinburgh Medical Journal* a year ago, for it appears this interesting syndrome receives less attention than it deserves. We are surprised that the lucid description of the curious ossification of the clavicle has not called forth a reference to that rare abnormality of a joint in its mid-shaft. We are thankful that there are few sentences so ambiguous as (p. 144), "If the brain of the infant is arrested in its growth, premature ossification of the sutures occurs, the condition of microcephaly resulting therefrom," the synostosis being the exception, not the rule, and the microcephaly being brought about by absence of brain-growth, not by presence of ossification.

Certainly the profession is indebted to the distinguished author for the absence of a confusing terminology. Justifiable alterations have been admitted, but while deprecating eponymous nomenclature we welcome with fond appreciation many old terms, confident that a day of saner appellation is dawning.

We give the new edition our heartiest greeting and our strongest recommendation.

Indispensable Orthopædics. By F. CALOT. Second English Edition. Translated by A. H. ROBINSON, M.D., M.R.C.S. Pp. xii + 1108, with 1163 illustrations. London: Baillière, Tindall & Cox. 1921. Price £2, 2s. net.

This edition has been translated from the Seventh French Edition, and, as before, deals especially with treatment based on the technique employed by M. Calot at Berck.

The first part of the volume describes in great detail the methods of making and applying plaster apparatus, and the technique of puncture and injection in external tuberculosis, which is the treatment advised by the author, who strongly condemns open operation in these cases. "Remember," he says, "that tuberculosis does not love the knife, which rarely cures, often aggravates, always mutilates."

Under "Special Technique" all the Acquired and Congenital Orthopædic Affections are fully dealt with, and each step in the treatment is made quite clear by means of the numerous excellent illustrations.

In an appendix further notes are given on Cervical Adenitis and other tuberculosis lesions, the efficacy of the puncture and injection

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form of treatment being shown by a number of coloured plates. Syphilis of bones and joints, and the treatment of Acute and Chronic Osteomyelitis are also discussed, and the author concludes with an article giving his opinion on the value of Heliotherapy.

The translator has been eminently successful, and the volume should prove of the utmost value not only to the general practitioner, for whom it was primarily written, but also to those especially interested in orthopædic work.

The Wassermann Test. By CHAS. F. CRAIG, M.A., M.D. Second Edition. Pp. 268, with 58 tables and 12 illustrations. London: Henry Kimpton. 1921. Price £1, 5s.

The account of the Wassermann reaction given by Lt.-Col. Craig is certainly one of the best, if not the best, exposition of this difficult subject in the English language. An attempt has been made, and made successfully, to put within the reach of the general practitioner a connected and common-sense explanation of the methods used in the test, and, what is more important, its limitations are duly noted.

The book is divided into ten chapters, and it is difficult to say which of these is the best, but those dealing with the result of the test in various stages of syphilis, as an index of the prevalence of syphilis in communities, the effect of treatment on the reaction, and the examination of the cerebro-spinal fluid, all call attention to important facts which should be ever present in the mind of the general practitioner of medicine.

For practitioners especially, but also for the laboratory worker, Colonel Craig's book should prove an ever-present help.

Chemical Pathology. By H. GIDEON WELLS. Fourth Edition. Pp. 695. W. B. Saunders Company. 1920. Price 35s. net.

The fourth edition of this work has followed rapidly on the third, and even so, numerous recent investigations have necessitated additions to many sections, and alterations in some.

The chief additions are in the parts dealing with the essential factors governing growth, and in the sections on immunity, and on the multitudinous phenomena at present grouped under the general heading of anaphylaxis.

The particular value of the work lies in the fact that it is far removed from being a "text-book." There is no dogmatic division of the so-called "proved" from the "unproved"; every subject is dealt with in far greater detail than is necessary merely to present current views thereon; research work which has been so far unconfirmed finds here its place side by side with investigations which have become

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classical. Yet the knowledge of the writer is so wide that it is probable that most of the changes in future editions will be in the direction of additions and modifications rather than of deletions.

The author has considered the elimination of the first chapter in the interests of space-saving. It is to be hoped that he will retain it. It deals with the elementary principles of physical chemistry and of the chemistry of living cells, and is of great use to the many readers who are not physical chemists.

The book is as up-to-date as it is possible for any volume of its size and scope to be. Investigators in every conceivable branch of medicine will find it of the greatest value.

The Nose and Throat and their Treatment. By CHARLES A. PARKER, F.R.C.S. Edin., and LIONEL COLLEDGE, M.B., F.R.C.S. Eng. Second Edition. Pp. xv + 583, with 241 illustrations. London: Edward Arnold. 1921. Price £1, 5s. net.

This book was originally founded on lectures given at the Throat Hospital, Golden Square, with a view to helping those who were attending or had attended a short course of study at special departments for diseases of the throat and nose. This idea has been kept in view in the preparation of the second edition. After a concise description of the various methods of examination, including direct laryngoscopy, œsophagoscopy, and the suspension method, a chapter is devoted to methods of local treatment, with formulæ. Nothing very new appears among the formulæ, but some useful hints and directions with regard to their application are given. In a section on external operations tracheotomy and intubation are described and compared. The differences of the two operations are well brought out, and a definite opinion in favour of tracheotomy over intubation is expressed. Diathermy as a method of treatment receives some notice. Complications arising in the upper respiratory tract in the course of specific fevers have a chapter to themselves, and the laryngeal appearances in early and late phthisis are clearly described. The writers are guarded in encouraging operative interference in the larynx in tuberculosis. In a book of this size, one would have expected more consideration to be given to anatomy, particularly intra-nasal anatomy, operative procedure receiving a good deal of attention. Diseases of the œsophagus receive more than passing mention, and a good description is given of pharyngeal diverticula. The book can be recommended to students and practitioners as giving a useful general idea of the specialty.

NOTES ON BOOKS

The third edition of Dr Clive Riviere's book, *The Early Diagnosis of Tubercle* (Henry Frowde and Hodder & Stoughton, price 15s. net), has quickly followed the second, and does not show material changes. The importance of early diagnosis in pulmonary tuberculosis is very great, and the subject well deserves a special volume. It is thoroughly dealt with by Dr Riviere, and yet within reasonable limits. The book falls into two sections, pulmonary tuberculosis of adults, including apical pthisis and hilus tuberculosis, and the disease in children taking the clinical forms of tuberculosis of thoracic glands and hilus tuberculosis. In both sections physical examination is described in a very thorough and practical way, and the value of the tuberculine tests carefully summed up; and some instructive radiograms of the chest are included. It is an excellent book on a vitally important subject.

Nucleic Acids: their Chemical Properties and Physiological Conduct, by Walter Jones, Ph.D. (Longmans, Green & Co., price 9s.). This interesting and very complete monograph is now appearing in a new edition. While the general plan of the first edition has been retained, the author has rewritten much of the book, especially that part which deals with the physiological conduct of the nucleic acids.

The subject is treated under two heads. 1. A review of the chemistry of the nucleic acids from the early work of Friedrich Miescher in 1868 to the present day. 2. An account of the physiological conduct of the nucleic acids, including a section on the distribution of the purin ferments throughout the animal kingdom and the bearing of this distribution upon the theory of evolution. An appendix is devoted to the preparation of the nucleic acids, the isolation and purification of their constituent elements, and the demonstration of the purin ferments.

The book is one which makes a strong appeal to the biochemist. It is satisfactory not only from the point of view of the subject dealt with, but the practical experimental details suggest ways by which other biochemical problems may be approached and known methods of isolation and purification improved upon. An excellent bibliography completes this concise, able, and well-written monograph.

The Formation of Colloids, by The Svedberg (J. & A. Churchill, 7s. 6d. net), contains an outline of the general, physical, and chemical processes by which substances are obtained in the colloidal state. The conditions which modify the degree of dispersion are considered in some detail. The formation of gels is not dealt with, nor is any attempt made to give practical details of the processes described.

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The explanations given are lucid, and the monograph forms an excellent survey of the limited field with which it deals. A comprehensive bibliography is provided which should add to its usefulness.

The author of *The Care of Eye Cases*, by R. H. Elliot (Henry Frowde and Hodder & Stoughton, price 12s. 6d. net), has made it his object to write in plain and simple terms a book that will be thoroughly practical and helpful to nurses in charge of ophthalmic cases. He deals only with essentials and elementary facts. The greater part of the volume is devoted to a detailed description of the use, sterilisation, etc., of the various remedies at the disposal of the ophthalmic surgeon, and to the nursing of operation cases. He outlines also the principal features of the anatomy of the eye and the more important diseases, and explains briefly the special methods of diagnosis most usually employed. Instruments are dealt with in a profusely illustrated appendix. The book will be of great value not only to nurses but also to students and practitioners, as it contains many useful and practical items of information that are not to be found in the average text-book.

Colonel Maynard's *Manual of Ophthalmic Practice* (E. & S. Livingstone, price 25s. net), for senior students and junior practitioners, is based upon his lectures at the Medical College, Calcutta, and, naturally, is written from the standpoint of the worker in India. The author has a wide experience of cataract, trachoma, and many other external conditions, and the chapters relating to these are clear and concise. It is interesting to note that he considers extraction of cataract with capsulotomy safer, and calculated to give better average results than expression of the lens in its capsule. Certain of the other chapters are too condensed, and in some respects incomplete, even for a small text-book. Those dealing with the optic nerve and ocular muscles may be instanced. On the other hand, methods of examination are described in praiseworthy detail. The illustrations are mainly reproductions from well-known text-books. There are also a number of coloured plates which are, however, only moderately successful.

Colonel Maynard's *Manual of Ophthalmic Operations* (E. & S. Livingstone, price 21s. net) has been brought up to date by the inclusion of descriptions of the more recently devised operations for glaucoma and in other particulars. Some of the writer's descriptions lack clearness, and some of his views are decidedly unorthodox and open to criticism. His method of using local anæsthesia in extirpating the lacrymal sac seems inadequate. The book is well illustrated and six stereoscopic photographs of important operations are included.

Notes on Books

The fifth edition of *Squint, its Causes, Pathology, and Treatment*, by Claud Worth (Ballière, Tindall & Cox, price 12s. 6d. net), does not differ greatly from the earlier ones although some improvements have been made. The author describes the different varieties of squint with their appropriate treatments. There are also chapters on binocular vision, methods of examination, and the fusion sense. Great stress is laid on the carrying out of treatment from the earliest possible date, and maintains that very few cases will require operation if this is done. Worth considers a defective fusion sense an important cause of most squint, and fusion training therefore essential. He has abandoned tenotomy and performs double advancement for convergent squint.

The Extra Pharmacopœia, Vol. II., seventeenth edition, by W. H. Martindale, Ph.D., F.C.S., and W. W. Westcott, M.B., 17s. 6d. net. This second volume is more "extra" and less "pharmacopœia" than the first, dealing less with the applications of drugs and more with laboratory work and the scientific bases of medicine. The modifications of chemical theory resultant from the recognition of atomic change are brought down to date and made attractive and intelligible for men who are not specialists. About a hundred pages are devoted to bacteriological notes. The articles on Radiology and Radium are not merely references but clear and interesting summaries. We know of no book with a better right than these two volumes have to a handy place in a doctor's library.

Dr Halsted has contributed in *Ligation of the Left Subclavian Artery in its First Portion* (The Johns Hopkins Press, 1920) a masterly account of the surgery of subclavian aneurysm based on the recorded cases and on his own exceptional experience. He has operated on six cases of subclavian aneurysm, with a successful result in each case. In the majority of cases he would be inclined to test the effect in the first place of proximal, or proximal and distal ligation, as a large percentage of cases is cured by ligation alone. If pulsation persists, it is best to excise the aneurysmal sac after the original wound has healed. Any complete review of Dr Halsted's work is impossible in the space available. It is sufficient to recommend it to surgeons as a complete and most interesting account of what has been accomplished in this difficult field of surgery.

NOTES

THE Centenary of the Medico-Chirurgical Society of Edinburgh was celebrated at a Banquet held in the Hall of the Royal College of Surgeons, on 28th October. The President, Emeritus-Professor F. M. Caird, occupied the Chair, and the Croupiers were Sir James Hodsdon, Sir Robert Philip, and Dr John Thomson, the Vice-Presidents.

The President of the Royal Society of Medicine, Sir John Bland Sutton, proposed the toast of "The Medico-Chirurgical Society of Edinburgh," and presented an illuminated Congratulatory Address from his Society. The toast of the "Sister Societies" was proposed by Dr George Mackay, Vice-President of the Royal College of Surgeons, and was replied to by the President of the Royal Society of Edinburgh, Professor Bower; the President of the Royal Medico-Chirurgical Society of Glasgow, Dr W. K. Hunter; and the Senior President of the Royal Medical Society, Dr Davidson.

Among the guests were Principal Sir Alfred Ewing, the Right Rev. Dr Wallace Williamson, Dr Freeland Fergus, President of the Royal Faculty of Physicians and Surgeons, Glasgow; Dr Charteris, Dean of the Faculty of Medicine, St Andrews; Professor M'Kerron, President of the Medico-Chirurgical Society of Aberdeen; Dr William Fordyce, President of the Edinburgh Obstetrical Society; Sir James Mackenzie, and Sir W. Leslie Mackenzie.

The health of the President was proposed by Dr Freeland Fergus, and in his reply Mr Caird expressed the thanks of the Society to the Secretaries, Mr George L. Chiene and Dr W. T. Ritchie for their successful arrangement of the Celebration.

THE Managers of the Royal Infirmary have appointed James Haig Ferguson, M.D., F.R.C.P.E., F.R.C.S.E., and William Fordyce, M.D., F.R.C.P.E., to be Gynecologists to the Infirmary.

AT the meeting of the Royal College of Surgeons of Edinburgh held on 19th October, Sir David Wallace, C.M.G., was elected President for the ensuing year, Dr George Mackay, Vice-President, and Mr Alexander Miles, F.R.C.S.E., Secretary and Treasurer.

At the same meeting Mr John Smith Fraser, F.R.C.S.E., 50 Melville Street, Edinburgh, was awarded the Liston Victoria Jubilee Prize of £100 in recognition of his work on the Pathology of the Internal Ear and its bearing on the surgical treatment of that organ.

Notes

The following twenty-four successful candidates, out of seventy-three entered, who passed the requisite examinations in July 1921, were admitted Fellows:—Catherine Emslie Anderson, M.B., Ch.B. Aberd.; Pauchanan Chatterjee, M.B. Calc.; Patrick A. Bennet Clark, M.B., Ch.B. Edin.; James M'Murray Cole, M.B., Ch.B. Edin.; Peter C. Davie, M.B., Ch.B. Edin.; M.R.C.P. Edin.; Thomas A. J. Duff, M.B. Toronto, M.C.P. & S. Ont., M.R.C.S. Eng., L.R.C.P. Lond.; Ernest C. Dunlop, M.B., B.S. Durh.; Henry H. Elliot, M.B., B.S. Durh., M.R.C.S. Eng., L.R.C.P. Lond.; George D. Fairley, M.B., Ch.B. Edin.; Alec T. Gibb, M.B., Ch.B. Vict. Univ. Manc., M.R.C.S. Eng., L.R.C.P. Lond.; Arthur H. Guymer, M.B., B.S. Adelaide; John J. Kearney, M.B., B.Ch., B.A.O., R.U. Irel., M.D., N.U. Irel.; Oswald F. Lamb, M.B., Ch.B. Otago; Gordon B. Lowe, M.B., Ch.M. Sydney; Hugh E. M'Coll, M.B., Ch.B. Glasg.; John R. MacNeill, M.B., Ch.B. Aberd.; George Nicholson, M.B., Ch.B., M.D. Edin.; Frank C. Ormerod, M.B., Ch.B., M.D. Vict. Univ. Manc., M.R.C.S. Eng.; L.R.C.P. Lond.; George Raphael Buick Purce, M.B., B.Ch., M.Ch. Queen's Univ. Belfast; Jotindra M. Rakshit, M.B., B.S. Bombay; Cecil G. Richardson, M.R.C.S. Eng., L.R.C.P. Lond., B.S., M.D. Univ. Lond.; William S. Robertson, M.B., Ch.B. Edin.; John Scott, M.B., Ch.B. Edin., D.P.H.; Gilbert I. Strachan, M.B., Ch.B., M.D. Glas.

At the Examinations of the Board of the Royal College of Physicians of Edinburgh, Royal College of Surgeons of Edinburgh, and Royal Faculty of Physicians and Surgeons of Glasgow, held at Edinburgh in October, the following candidates having passed the final examination were admitted L.R.C.P.E., L.R.C.S.E., L.R.F.P. & S.G.:—V. P. Menon, India; J. B. Dobson, Glasgow; H. P. Samuel, Ceylon; H. Penn, London; G. J. Lamprecht, Cape Colony; Grace O. D. Evans, Wales; John I. Hagard, Dundee; Pauline Figdor, Glasgow; J. K. Sen, India; H. W. Amyes, New Zealand; P. E. Malloch, Scotland; Lee Ee Liat, Singapore; S. C. Alcock, Derby; Frank Walwyn, Derbyshire; William Campbell, Glasgow; L. H. Peries, Ceylon; J. B. O'Neill, Glasgow; and A. R. Rellum, Dutch Guiana.

At the recent Dental Examinations the following candidates passed the final examination and were granted the Diploma L.D.S., R.C.S. Edin.:—John M. Elliot, M.B., Ch.B., Edinburgh; Douglas G. Munro, Edinburgh; Michiel J. de Kock, South Africa; and Peter J. B. Dyce, Leith.

BOOKS RECEIVED

ABRAHAMS, ADOLPHE, and A. CLIFFORD MORSON. A Guide to Urinary Diseases	(Edward Arnold)	9s.
BOURNE, ALECK W. Synopsis of Midwifery. Second Edition	(John Wright & Sons, Ltd.)	15s.
BUZZARD, E. FARQUHAR, and J. GODWIN GREENFIELD. Pathology of the Nervous System	(Constable & Co., Ltd.)	30s.
COBB, IVO GEIKIE. The Organs of Internal Secretion. Third Edition	(Baillière, Tindall & Cox)	10s. 6d.
DICTIONARY of Practical Medicine. By Various Authors	(Cassell & Co., Ltd.) In three Vols. Per set	£5, 5s.
DOBELL, CLIFFORD, and F. W. O'CONNOR. The Intestinal Protozoa of Man	(John Bale, Sons and Danielsson, Ltd.)	15s.
FAIRBAIRN, JOHN S. A Text-book for Midwives. Third Edition	(Oxford Medical Publications)	25s.
GILTNER, WARD. Laboratory Manual on General Microbiology. Second Edition	(Chapman & Hall)	21s.
HORSLEY, J. SHELTON. Operative Surgery	(Henry Kimpton)	52s. 6d.
LANE-CLAYTON, JANET E. Hygiene of Women and Children	(Oxford Medical Publications)	15s.
LYLE, H. WILLOUGHBY, and DAVID DE SOUZA. Manual of Physiology. Second Edition	(Oxford Medical Publications)	21s.
MACLENNAN, WILLIAM. A Manual of Diseases of the Stomach	(Edward Arnold)	21s.
PLATT, HARRY. The Surgery of the Peripheral Nerve Injuries of Warfare	(John Wright & Sons, Ltd.)	4s.
QUERVAIN, F. DE. Clinical Surgical Diagnosis for Students and Practitioners. Third English Edition	(John Bale, Sons and Danielsson, Ltd.)	50s.
ROGER, G. H., F. WIDAL, and P. J. TEISSIER. Sous la direction de Nouveau Traité de Médecine	(Masson et Cie.) Fasc. III.	Frs. 40
	" VII.	" 35
ROGERS, Sir LEONARD. Bowel Diseases in the Tropics	(Oxford Medical Publications)	30s.
SHERREN, JAMES. Lectures on the Surgery of the Stomach and Duodenum	(H. K. Lewis & Co., Ltd.)	4s. 6d.
STODDART, W. H. B. Mind and its Disorders. Fourth Edition	(H. K. Lewis & Co., Ltd.)	22s. 6d.
SURGICAL REPORT. Woman's Hospital in the State of New York, 1920	(Edited by George Gray Ward, Jr.)	—
THOMSON, ALEXIS, and ALEXANDER MILES. Manual of Surgery. Sixth Edition	(Oxford Medical Publications). Vols I. and II.	12s. 6d. each
WRIGHT, Sir A. E., and LEONARD COLEBROOK. Technique of the Teat and Capillary Glass Tube. Second Edition.	(Constable & Co., Ltd.)	42s.
YOUNG, JAMES. A Text-book of Gynecology	(A. & C. Black, Ltd.)	15s.

I N D E X

(*Cl. Rec.*)=Clinical Record. (*Crit. Rev.*)=Critical Review.

- ADENOMA of the Bile Ducts, A Case of (Greig), (*Cl. Rec.*), 145
- Air-Swallowing and some other "Bad Habits" in Infants and Young Children, On the Clinical Aspects of (John Thomson), 313
- A Medical Student's Expenditure Seventy Years Ago, 297
- Analytical Notes, 311
- Appendicitis, Mesenteric Lymphadenitis simulating (Struthers), 22
- Appointments, 184, 380
- Arsenic Poisoning, Chronic (R. Stockman), 1
- Art, The Relation of, to Modern Medicine (Sir Dyce Duckworth), 353
- Arteries, The Relationship of a General Contraction of the, to the State of Shock (Malcolm), 249
- Austria, Health Insurance in, 121
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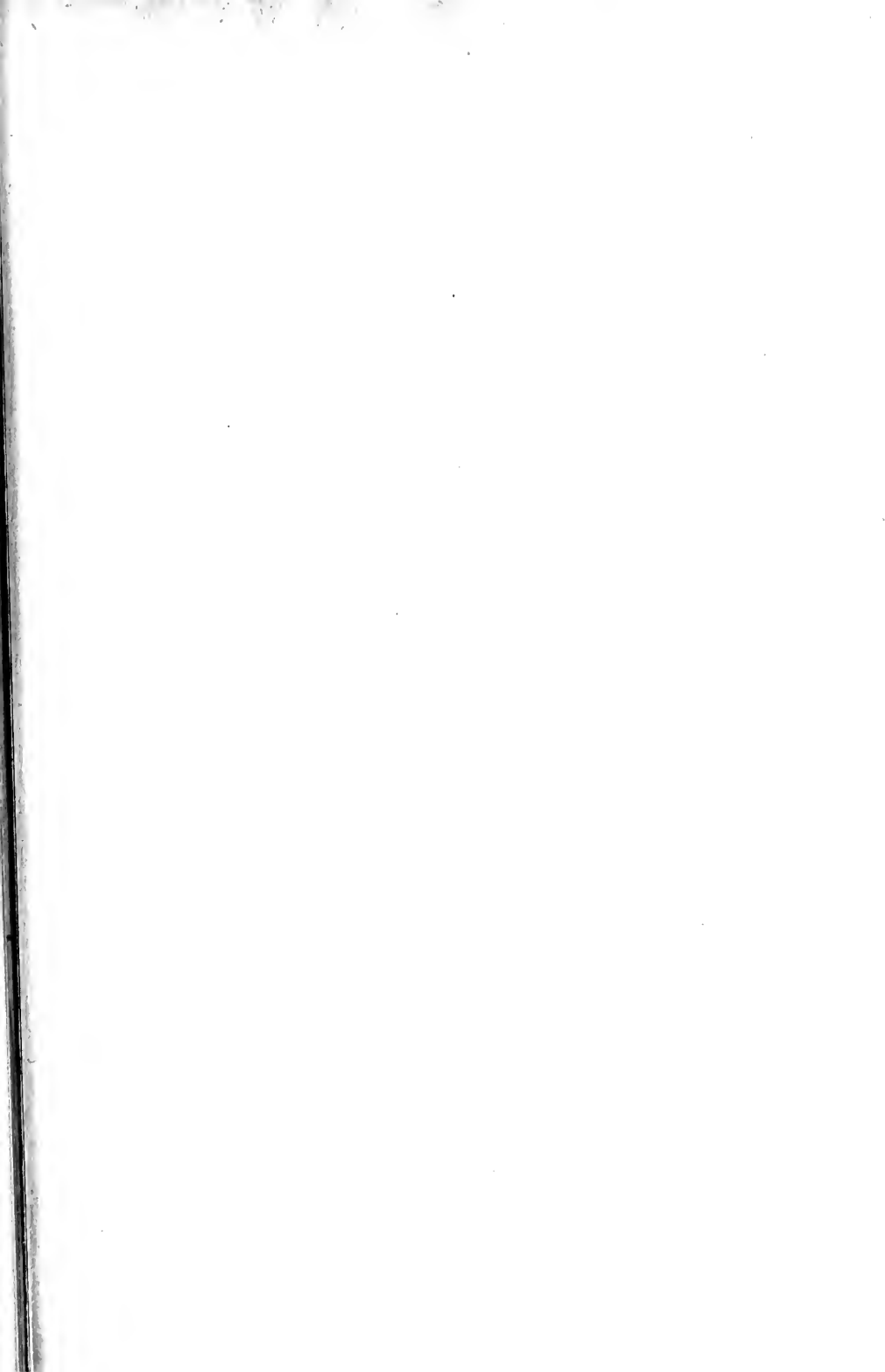
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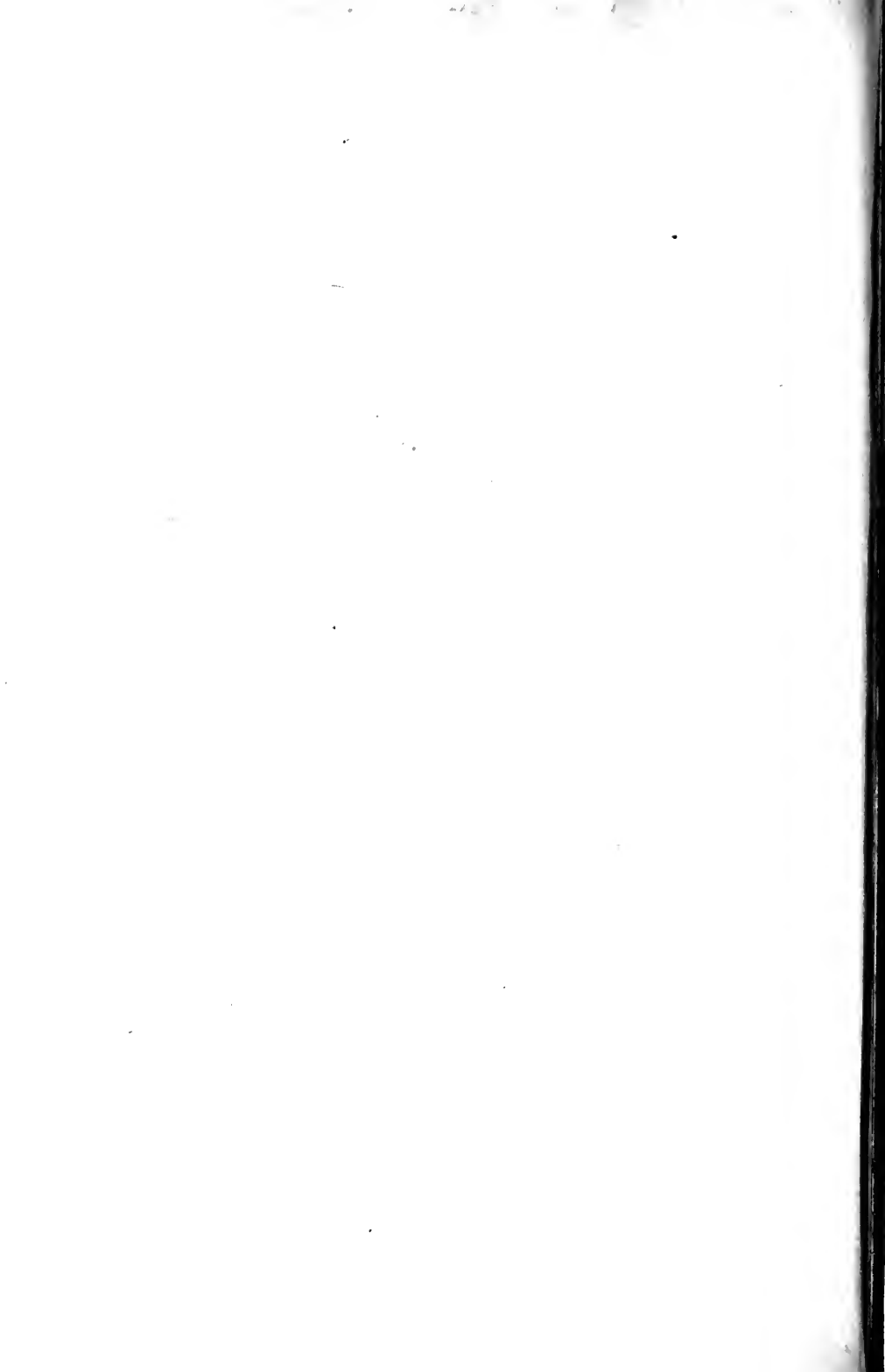
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